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PANEL (SAP) OPEN MEETING :  
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OFFICE OF PESTICIDE PROGRAMS' PRELIMINARY  
EVALUATION OF THE NONDIETARY HAZARD AND EXPOSURE  
TO CHILDREN FROM CONTACT WITH  
CHROMATED COPPER ARSENATE (CCA)-TREATED WOOD  
PLAYGROUND STRUCTURES AND  
CCA-CONTAMINATED SOIL

October 24, 2001

[2:00 p.m.]

Sheraton Crystal City Hotel  
1800 Jefferson Davis Highway  
Arlington, Virginia 22201

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14    John Wargo, Ph.D.

1 DR. ROBERTS: Dr. Stillwell, are you set up for your  
2 presentation?

3 We had one of our panel members join us after our initial  
4 introductions this morning. I'd like to give him the opportunity to  
5 introduce himself to the other panel members and the audience at  
6 this time. Dr. Adgate, welcome.

7 DR. ADGATE: I'm John Adgate. I'm from the University of  
8 Minnesota School of Public Health. My expertise is in exposure  
9 assessment and risk analysis.

10 DR. ROBERTS: Great. And, also, before we great started,  
11 let me make a request. For folks in the audience who have cell  
12 phones, please turn their ringers off. We appreciate at it. Thank  
13 you.

14 Our first presentation this afternoon is from Dr. David  
15 Stillwell. Let me turn it over to you and to the Agency to lead off  
16 our presentations this afternoon.

17 DR. STILLWELL: I'd like to thank everybody for inviting  
18 me. My name is David Stillwell, and I'm an analytical chemist at  
19 the Connecticut Agricultural Experiment Station in New Haven. I  
20 got involved in the arsenic dislodged from CCA wood as a result of  
21 some of the other issues that I'm also studying.

1           And the next slide here, wood preservatives are used because  
2           they extend the life of the wood. They protect it from harmful  
3           organisms, and they reduce the use of forest products. But any  
4           preservative has the potential for environmental effects some of  
5           which I've outlined on the next slide.

6           Some of the issues involving treated wood include the  
7           translocation of the material to soil and water via the leaching of  
8           the wood, of CCA from the wood, runoff from lumber yards,  
9           sawdust, and physical wearing of the wood; and then, also, maybe  
10          cleaning events such as sanding and power washing. All those will  
11          remove some of the preservative and transport it into soil and  
12          potentially from the soil into water.

13          The human exposure pathways includes arsenic dislodged  
14          from surfaces, the focus of this discussion. Also, there's some  
15          exposure questions during construction and plant uptake,  
16          particularly around raised-bed gardens.

17          With marine organisms, the copper and arsenic are -- the  
18          copper is also a toxic element. But for land uses, the arsenic is the  
19          one I focused on. There's also the disposal issues of the old wood.

20          As far as the disposal goes, something that everybody agrees  
21          on is not to burn the wood. Burning the wood creates toxic ash as

1 well as toxic fumes. And I think that's something everybody's on  
2 the same page on.

3 On the next slide, I show some of the studies that are  
4 underway at the Connecticut Agriculture Experiment Station.  
5 We've done a couple of studies on the amount of copper chromium  
6 arsenic in soils, under decks, and also under highway noise  
7 barriers built with that material. We're doing the arsenic  
8 dislodged from wood surfaces. That's the topic of this afternoon,  
9 plant uptake of arsenic, and then, also, coating effects.

10 On the next slide, the topic of my discussion this afternoon  
11 will be my experiences with the arsenic dislodged from the  
12 treated-wood surfaces and how those values relate to other  
13 people's work.

14 There's a controversy which we all know about. And on the  
15 next slide, I'm going to give the background of the study that I'm  
16 going to talk about.

17 I did a very extensive study on boards purchased at lumber  
18 yards where I determined the total amounts over time, the  
19 variability, the weathering and coating effects, and compared that  
20 to a very limited playground study.

21 Now, the method that I used, on the next slide, was similar

1 to that outlined by the Consumer Product Safety Commission in  
2 that I attached polyester wiping material that had ultimately been  
3 dampened to one and a half times its weight onto a wood block,  
4 pushed it back and forth five times across the surface; took the  
5 wipe material, put it back into the sample cup; and digested it  
6 using nitric acid at 60 degrees for two hours.

7 On the next slide, I'm going to show the wipe apparatus.  
8 There's problems with this any time you do this. Some of the  
9 problems with using this particular type of cloth material is that,  
10 with older wood, you wind up with lots of hills and valleys and the  
11 entire surface might not be wetted so you might have an effect of  
12 surface area that changes.

13 And to minimize that, we put a rubber pad that had been,  
14 also, sealed with polypropylene on the inside of that block  
15 assembly. But that also doesn't eliminate entirely as opposed to  
16 some of the work I've done with wet sponges.

17 But with a wet sponge, you don't have a uniform force going  
18 back and forth. There's been some other things where they've used  
19 test tube brushes and vacuums. But for most purposes, I think this  
20 wiping seems to be the way most people are going.

21 What was asked earlier was what were the effects of the

1 surface area on the wipe. And we wound up doing about 250 or so  
2 square centimeters on the wiping surface for a sample. And we  
3 convert that to micrograms of arsenic per hundred square  
4 centimeters.

5 Now, the idea there was that eventually you're going to have  
6 a surface-area effect. You could visualize taking that block of  
7 wood, going all the way around the table, and then measuring that  
8 surface area. And you're not going to pick up as much material  
9 because you're going to start dragging it around.

10 On the next slide here, I showed some of the quality control  
11 things that we did to qualify this method. The Alphas are the  
12 polyester wiping materials that are clean room wiping materials  
13 that we got through Fisher Scientific as well as the nylon. These  
14 are all clean room wipes that we purchased directly through Fisher  
15 Scientific.

16 The recovery of this extract material which is what we just  
17 took some of the CCA powder and extracted it with acid, put some  
18 on the glass, let it dry out, and then moved the material back and  
19 forth.

20 You can see the amount that we recovered versus the amount  
21 that we expected was close to 100 percent had we dampened the

1 material. And it was a little bit variable when we didn't dampen  
2 the material, and it was also somewhat wipe-material dependent.  
3 But at any rate, we didn't get back what we expected to get back  
4 with what we spiked it with.

5 So as a starting point, we thought that the glass surfaces  
6 would be a good starting point for any method. If you can't get the  
7 stuff out of the glass, then you don't have a good starting point for  
8 comparison. So everybody could do some things like that and  
9 other spiking methods matched.

10 Surfaces on CCA are another way you could do a method  
11 development. I subsequently found that you can get fairly  
12 well-matched materials once you have your method or your close-  
13 to-method developed. And you can go back and use those matched  
14 surfaces to maybe do your hand comparisons and those sorts of  
15 things.

16 But until you have a surface and until you know that that  
17 surface two-feet away is pretty much the same amount of arsenic  
18 as the surface right next to it, then you really don't know what  
19 you're really comparing because it could be 50 micrograms over  
20 here, 100 micro grams over here, and you're just finding of the  
21 variability within a board or a surface versus the variability of the

1 method. So that's something you need to watch out for.

2 On the next slide I'm showing the survey that we did. What  
3 we did is we wound up getting some boards from three different  
4 lumber yards. Each set was three to four boards. We cut the board  
5 into one- or two-foot pieces which we call "coupons." And we  
6 took the coupons out and looked at the dislodgeable arsenic on the  
7 coupons as they weathered.

8 Four of the sets consisted of the regular CCA board, and  
9 three of the sets consisted of the CCA wood plus water repellant,  
10 which we heard about a few minutes earlier. And sampling  
11 duration was between one and two years for each set.

12 The scheme is outlined on the next slide. Notice these are  
13 the water-repellant boards that we used. This one here we actually  
14 used this one starting with the water-repellant board. We bought  
15 this at a lumber yard. And these are, in my opinion, much  
16 superior. And as a matter of fact, this was the only material  
17 available for deck planking at that particular lumber yard was this  
18 water-repellant board.

19 This boards here, which we got from Lowes and the Home  
20 Depot, were purported to be of the higher quality such as Top  
21 Choice and things like that. These are higher quality boards which

1 I don't disagree with. They weather quite nicely. They're much  
2 superior, and they're checking and weathering without coating  
3 than the regular boards.

4 So the first thing I want to discuss on the next slide would be  
5 the variability and weathering effects.

6 On the next slide here, this is sort of the sampling scheme.  
7 You have so many boards within a set. And you take the coupons;  
8 you cut some of the pieces from the boards and call them coupons.  
9 So you wind up with a nested sort of design.

10 So you want to find out: what is the variability within a  
11 board, that is, between the two coupons; What's the variability  
12 within a set, that's the variability between those three boards;  
13 what's the set-to-set variation; what's the variation over time.

14 Well, in the next slide, I'm showing you the weathering that  
15 was done during the study.

16 And on the next slide, this is an example of how the data was  
17 taken. This happens to be something called "Board 13," which we  
18 had two pieces of wood from. We took the wipe samples from each  
19 coupon, measured them. One looked like around 90 here, around  
20 60 there. That was the two coupons from a particular board.

21 Then we took Boards 13, 14, and 15; and those are the values

1 for that particular set for that particular day. So for example, that  
2 particular set, which happens to be the water-repellant boards, is  
3 Set 5 and that's right here. And that turned out to be 51  
4 micrograms of arsenic plus or minus 23, with a plus or minus 23  
5 reflects the variability between the boards. Then you can also  
6 have your variability between the sets.

7 So to summarize all that, on the next slide, the average  
8 variability within the boards were about 17 percent, so that was  
9 the difference about the average; whereas the other ones were  
10 approximately 40 percent where there really wasn't too much  
11 difference between the between-board variation and the  
12 between-set variation.

13 Now, to show you how these things varied over time, that's  
14 illustrated in the next slide. This right here happens to be one of  
15 the water-repellant boards, and we're following it over one year.  
16 We're calling these Boards 10, 11, and 12. And the error bars  
17 reflect the variation within the board, the coupon variation.

18 This is the variation of the board with time. And the whole  
19 things would be -- the average of all these would be the variation  
20 within a set over time.

21 You can notice that with these water-repellant boards that

1 over one year there was no marked decrease in the amount of  
2 arsenic dislodged over one year. Also, if it happened to be one of  
3 the higher boards, like this was more or less higher than this board  
4 here, 12, is that they follow the same general pattern.

5 The next slide I show some of the regular boards. They may  
6 or may not be reaching some steady state as shown on the next  
7 slide.

8 You have to be careful in your time frame. Here we have two  
9 that were carried out for two years. This is the data that I have for  
10 the two years. You can see that at the end of one year, you may  
11 have thought it's going to go down. But low and behold, it goes  
12 back up again.

13 We think the rejuvenation has to do with the combination of  
14 erosion. Also, there's a diffusion process that can occur from the  
15 interior of the wood back up to the surface. And that is  
16 outweighed by the fact, when it rains, some of the material on the  
17 surface will leach away. So you have competing processes going  
18 on which I don't -- I can't -- I certainly haven't measured.

19 The fellow that talked yesterday would be more capable of  
20 measuring that with microtomes and things, that is, what is the  
21 competition between the diffusion from the interior of the wood to

1 the surface versus the leaching from the surface of the material,  
2 and, also, the ageing effects for more than two years.

3 And the next slide, here is the average of each set over two  
4 years. Some of them actually stopped over one year. So there's no  
5 real, real trend downward. This wouldn't be a statistically  
6 significant line going down.

7 And on the next slide, this is just showing that some of the  
8 surface changes over time. To begin with, the surface, the  
9 chromium-to-arsenic ratio is 1.1. And over time, that ratio  
10 increases suggesting that the arsenic on the surface becomes  
11 depleted which is consistent with the fact that the arsenic has a  
12 greater propensity to dissolve from the wood or leach from the  
13 wood as does copper as opposed to chromium.

14 So there are changes in the ratio found over time, and we  
15 haven't really completed that study at all with the ratios. But  
16 there is something that's going on that we might be able to  
17 comment on.

18 So to conclude the variability and time effects of the study  
19 on the next slide, the within-board variability was about 17  
20 percent; and everything else was in the neighborhood of 40.  
21 Within a set, the arsenic dislodged tended to follow the same board

1 order over time.

2       So if you had a particular board or object that was high, it  
3 would tend to stay high over the length of the study. The ratio  
4 increased with weathering. And over this one- or two-year time  
5 frame, the decrease was not, certainly not, a demonstrated  
6 effectively or even strongly suggested over one or two years.

7       However, after 5 years or 10 years, when you get a nice,  
8 brown, weathered layer, I do expect that there will be a decrease. I  
9 just haven't be able to show it. And maybe there just won't be.

10       On the next slide. So to summarize this, I'm going to show  
11 the actual amounts we found on these coupons, compare them to  
12 the amounts that I found on playscapes, and then compare them to  
13 other people's work.

14       So in the next slide, the overall ranges and averages for this  
15 study I just described were between 5 and 122 micrograms of  
16 arsenic per 100 square centimeters for the regular CCA wood; and  
17 the water-repellant wood was between 8 and 110. The overall  
18 average was 34 plus or minus 22, a median of 27.

19       On the next slide, it shows a histogram. And most of the  
20 numbers here are in the neighborhood of, oh, say, 30 to 40,  
21 between 10 to maybe 40 micrograms arsenic per square centimeter.

1 And you have some on this range and some on this range.

2 On the next slide here, this just shows that the  
3 water-repellant boards -- actually, this one was bought one year  
4 before these other two sets, and they had remarkable similarity in  
5 their averages compared to the regular CCA board. These are more  
6 well-behaved, but they certainly do leach arsenic as good, if not  
7 better than -- I mean they dislodge arsenic as good or better than  
8 these regular CCA boards.

9 The original thought here, of course, was because it had a  
10 water repellent or a coating was that it would not have any  
11 dislodgeable arsenic. And that's not true.

12 The next slide here is showing some of the chromium data.  
13 This is slightly higher than the amount of arsenic that was found  
14 because of the later times. This value is not 1.1 times 34 but  
15 higher because, later on in the study, you know, the chromium is  
16 more concentrated on the surface. But these are the numbers for  
17 the chromium. And all these elements were done by ICP, and so  
18 there's no speciation at all.

19 On the next slide, we did a small study on three playgrounds  
20 where we sampled the horizontal surfaces using the method that I  
21 described, the wipe method, the block.

1           And then we, also, did some very limited stuff on posts  
2           where I took the wipe material on my hand and went back and forth  
3           in a manner that was hopefully consistent with the horizontal  
4           structure there. And the results are shown in the next slide.

5           And here are the averages and so on. The average actually is  
6           8.8 here. That's a typo. That's the median, not the average. But  
7           the average is 8.8. But these numbers are the ranges, and the  
8           averages are less than those that I just showed for the coupons for  
9           these horizontal surfaces.

10          And in the very limited study on the poles using a different  
11          method, they are certainly much higher. And this is certainly just  
12          suggestive and not nearly as tight of a number for comparison as  
13          these here.

14          So on the next slide. So why were the test coupons greater  
15          than the playscape surfaces? Well, there could be the time effects  
16          and that the playscapes were just sampled one time. There were a  
17          lot of variations over the course of a year with the coupons. It may  
18          have just been one of the times when it was lower. There can be  
19          ageing effects, weathering effects, coating effects, and those sorts  
20          of things.

21          There's only one playscape that appeared to be coated. The

1 other ones didn't appear to be coated. There's also the physical  
2 wearing of buffing effect by repeated physical contact, and this is  
3 something we could look into.

4 And so on the next slide, I'm going to show something about  
5 that. And that's the effects of consecutive passes on the same  
6 surface. And that's relevant to planks, hand rails, and other  
7 surfaces that are frequently contacted.

8 So we took one piece of wood from every one of our sets and  
9 two of the two by eights; and then we did five passes for each  
10 board following the standard method. So this would be five passes  
11 in addition to our normal five passes.

12 So on the next slide, what I'm talking about are Passes 1, 2,  
13 3, 4, and 5. We did our five back-and-forth movements here and  
14 then changed the wipe material to a different wipe material and  
15 sampled it here and here and here and here.

16 And there's a definite -- these are all brand-new pieces of  
17 wood, and there's a definite decrease in the amount. This is  
18 normalized to the amount that was found in the first pass, which  
19 would be 100 percent. And the average is shown on the next slide.

20 Oh, sorry. That's actually showing the actual arsenic  
21 dislodged rather than the normalized amount. The first one I

1       showed with the normalized amount. This is the actual arsenic  
2       dislodged. And you can see that it's going down, too.

3             So in the next slide, here's the average of all those. And it's  
4       fairly well behaved with the new wood. So with brand-new wood,  
5       repeated passes on the same surface will result in lowering the  
6       amount of arsenic dislodged from the surface.

7             However, after time, on the next slide, you can see that if  
8       you take these pieces of wood that have decreased in value -- this  
9       happens to be the water-repellant boards -- they started out at a  
10      percent of the first pass, which would be 100 percent. By the time  
11      you kept on rubbing it and buffing it and everything else, it went  
12      down to about 25 percent of its value.

13            You put it out to weather, and there's a rejuvenation effect  
14      due to weathering, maybe there was a reroughing of the surface,  
15      that sort of thing. But definitely after 60 days of weathering, it  
16      went back up to its original value.

17            And then if we look at it after 207 days, we did another five  
18      passes. 207 days, the rejuvenation effect was not nearly as  
19      pronounced and maybe there's some sort of steady state going on;  
20      but certainly there can be. With the brand-new wood, this effect is  
21      very pronounced and is shown on the next slide as well and the

1 next slide.

2 Although this is the standard of boards, it's not nearly as  
3 pronounced; and you might have a little bit of a different behavior.

4 On the next slide, I averaged them all. Lots of variation in  
5 time. You can see that, even if you do repeatedly contact the  
6 surface here, you don't go down to anywhere near zero. You wind  
7 up with maybe about 50 percent or so of the original number.

8 So on the next slide, I conclude this. So they tended to  
9 decrease with increased contact frequency most consistent with  
10 new boards. So there could be less arsenic dislodged from the  
11 surfaces that are frequently contacted, depending on how frequent  
12 the contact is and how old the board is.

13 There are certainly some rejuvenation effects that are most  
14 noticeable with the newer boards, and the weathered boards looked  
15 like they may approach more of a steady state. But that's not  
16 known either if you just let them sit for a year or two.

17 But these consecutive passes more or less reflect more  
18 frequent use of the boards as opposed to just letting them sit out  
19 there for three months and sampling them every three months,  
20 which is what I did in the previous study.

21 So now on the next slide, I'm going to compare my values to

1 the reference values that are found in your Table 5 in EPA's final  
2 element. This is showing the average amounts of arsenic  
3 dislodged by the entry number in Table 5 on a log scale with the  
4 min, the max, and the average.

5 So just as we saw yesterday with the Environmental Working  
6 Group, there were large variations in each one of these studies.

7 And in the next slide, I've reduced them just for clarity to  
8 just include the various groups. These are the data from  
9 California. This is the data that I just showed you. This is the  
10 data by Riedel, Osmose, Wilson and Gjovic, Doyle and Malagard.

11 And the playscapes, now some of these were actually  
12 playscapes. This one here, No. 1, No. 3, No. 9, No. 10, No. 11,  
13 and Nos. 13 and 14 down here, these were all playscapes.

14 Other field studies were Nos. 2, 4, and 6. And then the other  
15 ones are entries 7, 8, 12, 15, and 16 were test pieces: Coupons,  
16 old wood, new wood. Just pieces of wood that were tested. So  
17 they reflect a lot of different situations.

18 All of them used the gauzes, pads, or paper, except for No.  
19 15 here which used the test tube brush. These two data were using  
20 a test tube brush that was wet. And this one right here used a test  
21 tube brush. So there's some indication that using a test tube brush

1 to wipe it, of course, is more aggressive than just using a gauze or  
2 a wipe or that sort of material.

3 This very high one was the pier, the fishing pier, probably  
4 near the Monterey Bay Aquarium right outside the Monterey area.  
5 That is something that wouldn't be found in a playground but was  
6 found in a pier where, certainly, if it's there by the Monterey Bay  
7 Aquarium, there's tons of children there every day.

8 So another way of looking at this is on the next slide. From  
9 Table 5, there were actually 10 groups of researchers involved.  
10 They generated 43 data sets. The comparison between using a wet  
11 wipe, a dry wipe, a dry hand, and a vacuum brush is shown here.

12 Here's the median data; here's the average; and here's the  
13 average where I've omitted one high and one low mainly to reduce  
14 the scatter over here. The scatter is just really high. So if you  
15 omit one high and then one low, you wind up with a lot less scatter  
16 in the results.

17 So if we plot that on the next slide here, you can see that  
18 there is a big increase in using the vacuum brush method. But  
19 between the wet, the dry, and the dry hand, there's very little  
20 difference overall.

21 But on a particular surface, certainly, I would expect with

1     these two, because I've shown that on the glass, is that the wet  
2     would certainly be higher than the dry under the circumstances of  
3     new wood or where there's a lot of soluble material. The wet  
4     material, the wet wipe, will pick up the soluble material. And the  
5     dry wipe, I'm pretty sure, would miss the soluble material.

6           Unless, of course, the dry wipe is taken on a wet wood  
7     surface which would be right after a rain or something, which is  
8     something I never did. All the data that you saw was at least two  
9     or three days after a rain when all the wood was nice and dry and  
10    everything.

11          And another way of complicating the matter would be to see  
12    what happens right after the rain. And, you know, one could argue  
13    that it would be less or more, depending on how much rain had  
14    fallen. And there was some reference in the literature that  
15    somebody found that if it misted, it might be more than if it was  
16    like a torrential rain and that sort of thing.

17          So the comparisons and conclusions on are the next slide  
18    here. As we've been seeing all along, there's a huge variation that  
19    extends between groups, within groups, comparing surfaces, and  
20    within a group of samples. There's a variation in results due to  
21    methods, surfaces, retention, age.

1        There was one study in there on that Table 5 where they  
2        actually found -- that was one of the test tube brush studies, where  
3        they found a difference with two by fours with age. That was  
4        just one study, though.

5        There's certainly very limited on method comparison,  
6        although the vacuum brush was, I believe, compared in the  
7        California study pretty substantially. And it certainly is much  
8        higher than any of these others.

9        So overall, the median for all these studies -- the wet, dry,  
10       and hand -- was somewhere between 26 and 70 micrograms arsenic  
11       per hundred square centimeters with the average being between 65  
12       and 203.

13       On the next slide, some more conclusions. The arsenic was  
14       above the detection limit in most of these samples. If there is  
15       arsenic dislodged, most everybody finds it.

16       There's certainly a need for uniform methods. There's  
17       certainly a need for more lab studies as we saw one yesterday so  
18       that we can develop some sort of a leach dislodgeable model,  
19       based upon some real variables, function of diffusion from the  
20       interior, the leaching from the surface as well as the particles  
21       removed from the surface.

1           So on the next slide, another thing that suggests itself. And  
2       lots of citizens call me all the time. And one of their questions is  
3       what to do with an old deck. And what you do with it is you have  
4       to scrub it, sand it, or power wash it to clean it up.

5           And I suggest really light scrubbing, and certainly this  
6       vacuum brush would suggest that if you sand it or power wash it,  
7       that sort of thing, you certainly would be dislodging a lot of stuff  
8       from the surface.

9           On the next slide the theoretical amounts of arsenic  
10      dislodged from the surface on .4 -- 2.5, .4, .6, and 2.5 pounds of  
11      preservative, the retention. The .4 is the stuff that you normally  
12      see and bind. This is the amount that would be in a volume of  
13      wood. This based on 2,800 parts per million arsenic and 100  
14      square centimeters times a certain thickness in microns.

15          So if you happen to find some way of removing 5 microns of  
16      wood and it's at .4, you'd wind up with about 75 micrograms of  
17      arsenic per hundred square centimeters. Human hair is  
18      approximately 20 to 150 microns.

19          So this puts it in that kind of perspective that these numbers  
20      really aren't -- you know, it's pretty easy to visualize removing a  
21      couple of microns of wood. And this is the number that you're

1 going to get. This assumes that there's no arsenic depleted and no  
2 arsenic concentrated on the surface. This is some new stuff.

3 On the next slide -- I give this talk to the citizens of  
4 Connecticut. And to them I suggest that they don't put any animal  
5 or children's play areas underneath the decks. You're going to see  
6 in the next talk that the soils have arsenic on them, paint, or  
7 staining regularly. And I'm going to talk about that next.

8 There's alternative materials for contact surfaces such as  
9 wood composites. There's cedar; there's western cypress; there's  
10 the composite woods, the wood polymer composites, such as Trex.  
11 There's also, instead of building a deck, why not consider a patio.

12 Some of the alternative materials. I did bring some ACQ  
13 with me here, and I'll be putting that on the table over here for you  
14 guys to look at. This is the stuff that contains no chromium and no  
15 arsenic. And it looks just like CCA wood. And you won't know  
16 that it wasn't CCA wood except it says that it's ACQ on it.

17 On the next slide, this is Trex, the wood polymer composite,  
18 at our bird and butterfly garden at the Lockwood Farm in Hampton.  
19 And it's about three or four years old now, and that has no  
20 dislodgeable arsenic on the surface.

21 However, you do need to use some sort of rot-resistant wood

1 to build a structure on the inside, such as ACQ. But since you  
2 can't get ahold of it, you have to use CCA around here in  
3 Connecticut. But at least the surface has no arsenic.

4 And this stuff is really -- from all indications from the  
5 people I've talked to, they like it. It's a good enough material to  
6 use. It lasts; it's maintenance free. I would certainly recommend  
7 it for consideration.

8 And that's it for this particular talk.

9 DR. ROBERTS: Before we go to the next --

10 DR. STILLWELL: Sorry. I'd like to point out that the work  
11 was done by our summer intern program. The people here carried  
12 out all the work. They're college students that come in and work  
13 for about eight weeks. And then some of them carry over into the  
14 school year. And then, also, Craig, one of the technicians that  
15 works here.

16 Okay. Thank you.

17 DR. ROBERTS: Dr. Stillwell, thank you. I'd like to provide  
18 the opportunity for some panel members to ask questions of  
19 clarification. I'll start with Dr. Smith, Dr. Solo-Gabriele, Dr.  
20 Mushak, and Dr. Chou.

21 DR. SMITH: Thank you, Dr. Stillwell. That was a very

1 informative presentation. And this is Andrew Smith from the  
2 Maine Bureau of Health.

3 Several questions of clarification. First, I was noticing on  
4 your outdoor structure that the coupons appeared fairly close  
5 together. Was there any concern about rain splattering and cross  
6 contamination or anything like that with your setup?

7 DR. STILLWELL: The outdoor structure.

8 DR. SMITH: Right. You appeared to have the coupons on a  
9 rack.

10 DR. STILLWELL: The rack, we felt, was high enough that  
11 the rain didn't splatter up and the soil went on top of it.

12 DR. SMITH: No. I'm more concerned with rain splattering  
13 from one coupon to another.

14 DR. STILLWELL: When we first started, we started with  
15 having them a little further apart. And then we really didn't think  
16 that was an issue; or if it was, it would be a minor issue.

17 DR. SMITH: Uh-huh. And when you would set them up for a  
18 given treatment solution or a given type of board, you would keep  
19 them all together; is that right?

20 DR. STILLWELL: Right. We had some control boards,  
21 nontreated boards, way away from the area. And we had

1 randomized them. They were all put together, and they sampled  
2 pretty much at the same time.

3 DR. SMITH: I'm also very intrigued by your variability  
4 analysis. I want you to help me with the correct interpretation of  
5 this.

6 The within-board variation was about 17 percent and, you  
7 know, about half that seen for between-board; and between-board  
8 was not that different for between-set nor was it that different for  
9 variation-over-time. Is the interpretation of that that the dominant  
10 source of variability is between-board, and that the variation-over-  
11 time or variation-between-sets doesn't seem to add that much  
12 appreciable increase in variance?

13 DR. STILLWELL: I haven't finished the nested design  
14 analysis on that to be able to tell you what the major source of  
15 variation is, if any. Just looking at it, I think that they're all  
16 pretty much the same other than the within-board.

17 DR. SMITH: But each one of these is a total variance  
18 measure; right? So each one includes --

19 DR. STILLWELL: The variation due to that particular  
20 variable.

21 DR. SMITH: Okay. I'll have to look at them.

1 DR. STILLWELL: You take the three numbers of a  
2 particular set; you find the average; and then you find out what the  
3 difference is.

4 DR. SMITH: Okay.

5 DR. STILLWELL: And then to do the formal nested design,  
6 there's more of a --

7 DR. SMITH: Right.

8 DR. STILLWELL: It's a different mathematical construction  
9 which is a lot more complicated using the sum of the squares and  
10 all this. And I haven't done that yet.

11 DR. SMITH: Do you know when that would be available?

12 DR. STILLWELL: Probably within a couple of months. This  
13 hasn't been published. It was only a preliminary work that was  
14 published. The full study hasn't been published yet. So this is all  
15 work in progress right now.

16 DR. SMITH: What is the status for these data being  
17 published?

18 DR. STILLWELL: It will be written up within a few months.  
19 I don't know when it will be published.

20 DR. SMITH: Right. Okay. Now, on method validation, you  
21 heard my questions earlier on this, and I saw you nodding your

1 head, I think, in agreement. Does that mean within the context of  
2 your study you also didn't do any work to look at whether or not  
3 these transfer coefficients of microgram per centimeter squared to  
4 what extent that estimate is sensitive to the surface area of that  
5 one actually sampled?

6 DR. STILLWELL: No. That hasn't been done. And I think  
7 the method is robust enough now to do things like that. When I  
8 first started, we had these two by eight boards that were a lot more  
9 variable within boards and everything was screwy. And our level  
10 of understanding wasn't very good.

11 But, yeah, I think we could probably do some things if it was  
12 well-designed where we could start making sense out of some of  
13 this with boards that were maybe aged for a few months so you  
14 don't have that dramatic brand-new board effect, that time effect.  
15 That one there looks like it kind of diminishes after about half a  
16 year.

17 DR. SMITH: And that leads into my next question. Your  
18 two-year time courses were interesting for the untreated boards,  
19 untreated meaning they don't have that water-repellant added to  
20 them. There did seem to be some sort of evidence of decline over  
21 the first year, but then it sort of seemed to bounce around or

1 bounce back up over the second, at least that was my interpretation  
2 of looking at the spread in the data.

3 Did you keep any records or information on, you know, sort  
4 of visual changes in the wood in terms of checking and cracking  
5 and to what extent your variation in data can be explained by that?

6 DR. STILLWELL: No, we didn't really have any real  
7 explanation for why it would go up and down and what would  
8 explain those sorts of effects. You know, you can think of the  
9 amount of rain, the temperature, the time, and that sort of thing.  
10 And we didn't really see anything yet.

11 I don't think we'll be able to find anything with this study.  
12 But that would be something that could be done with another  
13 study. It would be quite worthwhile. It would be more of an  
14 environmental chamber, that sort of an environment.

15 DR. SMITH: And last question, if I may. You have your  
16 comparison, as others have done, of some of the wipe data with the  
17 hand data. When you did that comparison across the studies, did  
18 you look carefully at how the hand data was actually computed to  
19 know whether or not we're talking about centimeters squared of  
20 hand-surface area versus centimeter squared wiped?

21 DR. STILLWELL: No. The hand -- yeah, a lot of this stuff

1 is not really very well -- well, well described. And the big issue  
2 seems like here is what would be the transference between that.  
3 And that is not something I can answer.

4 DR. SMITH: Okay. Great. Thank you.

5 DR. ROBERTS: Dr. Solo-Gabriele, and then Dr. Mushak and  
6 Dr. Chou.

7 DR. SOLO-GABRIELE: You described variability, and you  
8 had error bars on your plots. Is that standard deviation, or is it  
9 95-percent confidence limits?

10 DR. STILLWELL: That's just one standard deviation.

11 DR. SOLO-GABRIELE: I'm trying to get an understanding  
12 for the samples that were used. You had regular CCA. Then you  
13 also have water repellant with CCA that is factory applied water  
14 repellant in the pressure-treating solution. Or is it water repellant  
15 that was added after the wood was treated?

16 DR. STILLWELL: That's the water repellant that you buy at  
17 the lumber yard where the water repellant is pressure treated into  
18 the wood. And then that's more of a premium product. That over  
19 in Connecticut, at least, at one lumber yard, it was the only  
20 product to use for these deck surfaces.

21 DR. SOLO-GABRIELE: Because you mentioned

1 Thompsonized, I was wondering if it was Thompson Water Seal  
2 that was added afterwards.

3 DR. STILLWELL: Yes. It wasn't added, but that was the  
4 name of it. One was Lowes Top Choice. The other one was the -- I  
5 don't remember if the Home Depot was the Thompsonized or which  
6 one was which. But, yes.

7 DR. SOLO-GABRIELE: And the last question was: You  
8 have some data where you have wipe-off data for planks versus the  
9 support posts; and there's significant differences, it seems,  
10 between what you get off the planks versus the support posts lower  
11 from the planks and higher from the support posts. And it seems  
12 as though in your comment on the bottom or your statement says  
13 that's it's more because of the differences in the methods that were  
14 used to wipe the planks, the flat members versus the posts.

15 In addition to that, perhaps it was a difference in retention  
16 levels because those posts could have been structural members  
17 treated to higher retention levels.

18 DR. STILLWELL: Yes, you're right. It could have been a  
19 retention level. And, actually, in looking at the data in the last  
20 few days, I didn't really see a gigantic reason to suspect that just  
21 going from -- starting to use my hand on that wiping material

1 would make such a huge difference.

2 So it could be, yeah, that those posts have a much higher  
3 retention level. Or there could be something involved with  
4 vertical surfaces that we don't really understand.

5 But, yeah, it was really like only three or four data points  
6 from each structure. And it's very interesting to look at in regard  
7 to that because there are places where kids will like naturally just  
8 like grab ahold of that post as opposed to the ground. And if  
9 they're a lot higher, that might be a consideration.

10 DR. SOLO-GABRIELE: I don't know if the original wipe --  
11 you know, there's been a lot of hand-wipe tests and regular-wipe  
12 tests presented. I don't know if that was a horizontal members  
13 versus vertical members, but it would be interesting to see if there  
14 were differences observed between the two.

15 DR. STILLWELL: Yeah, that's what I was suggesting.  
16 Certainly, there's more to be studied there with the horizontal  
17 versus vertical.

18 DR. ROBERTS: Thank you. Dr. Mushak.

19 DR. MUSHAK: Two questions. First one is a mechanistic  
20 one.

21 Could you clarify for those coupons in which you had

1 depletion of arsenic, you then subsequently saw a rebound; or were  
2 these independent runs? Because I'm trying to rationalize how you  
3 remove arsenic from the chromium bond through these oxy bridges  
4 and then put arsenic back on, which would suggest that you're  
5 having intermatrix arsenic diffusion.

6 DR. STILLWELL: These are weathered over time. So when  
7 they're outside, there can be an erosion. So the surface is  
8 renewed. That's number one.

9 The erosion rate is, I think, 3 to 20 microns per month,  
10 according to some studies I've seen, at six millimeters per century.

11 Also, you can have a diffusion from the interior to the  
12 surface. That's one of things I think is happening. It's just what  
13 happens is you have -- we can just call it chromium arsenate.

14 And just by freshman chemistry solubility product, the water  
15 goes in, particularly, when the wood gets older. You have crack.  
16 You have all this other stuff. It's now saturated with water. A  
17 certain amount of that chromium arsenate will now go into  
18 solution just by solubility product rule and will just diffuse by  
19 diffusion and will wind up on the top and then maybe even  
20 concentrate as the water evaporates depending on what happens  
21 next. As it rain some more. So you can, yeah, you can dream up

1 all sorts of little --

2 DR. MUSHAK: Maybe logically you can exclude some and  
3 include others, chromium arsenic in a one-to one ratio migrating.  
4 How do you get net enrichment in chromium and depletion in  
5 arsenic if whatever they're doing is one to one?

6 DR. STILLWELL: Because it's not all chromium arsenate.  
7 There is also copper arsenate, copper oxides, and then there's the  
8 regular absorption in there and things like that. So it's been  
9 well-established.

10 Warner and Solomon and Aceto and Fedele in the early '90s,  
11 they did some work. They showed fairly conclusively with little  
12 tiny wood blocks at different pHs the copper comes out almost a  
13 hundred percent and then followed by the arsenic and then the  
14 chromium.

15 So these are observations. So based on the observation,  
16 yeah, it can't all be chromium arsenate because that's inconsistent  
17 with the experiment.

18 DR. MUSHAK: The second question goes to the behavior of  
19 your different test samples over time. I noticed that the one  
20 sample that started very high had these real increases, bump ups,  
21 in leachable arsenic over time much more so than the ones that

1 started lower. So is it the case that if you have a sample that starts  
2 at a much higher wipe level that that is over time going to be more  
3 mobile or more subject to seasonality?

4 DR. STILLWELL: That's quite possible, yeah. They tend to  
5 stay up there.

6 DR. MUSHAK: If you look at that one sample, that's very  
7 striking.

8 DR. STILLWELL: But they were treated. Yeah. There is no  
9 real standard on what constitutes an acceptable level of  
10 dislodgement, which would be, maybe -- you know, people could  
11 say if it was above 50 or 100 or whatever. But that's -- as we have  
12 with the soil.

13 DR. ROBERTS: Dr. Chou.

14 DR. CHOU: Dr. Stillwell, you present your results very  
15 clear. The first study, I wonder if you would clarify the last point  
16 of your summary for us, your conclusions.

17 The conclusion is saying decreases in arsenic over time is  
18 not shown by this data. I believe you draw that conclusion from  
19 the slide you show two pages ago, the reason it showed no  
20 changes. In the last few questions, we're talking about changes.  
21 So there is changes. Is it because analysis is done over two years

1 of time? If you just do the first year of analysis, you could see a  
2 decrease of arsenic; isn't that true?

3 DR. STILLWELL: Yeah, I think in probably three of the --  
4 the two water repellants didn't show anything. The three water  
5 repellants showed nothing. But the three regular, the other boards,  
6 if you just would have gone for one year and then stopped, that  
7 would have -- it would have suggested that it decreased to some  
8 minimum number.

9 DR. CHOU: Thank you.

10 DR. ROBERTS: Dr. Thrall.

11 DR. THRALL: Mary Anna Thrall. Back to your graph on  
12 your variability between boards within a set and over time. What's  
13 the methodology for measuring arsenic?

14 DR. STILLWELL: Which graph are we on?

15 DR. THRALL: Variability between boards within a set and  
16 over time.

17 DR. STILLWELL: For example, this one here.

18 DR. THRALL: Uh-huh. Again, I'm just naive. What's the  
19 methodology for measuring arsenic?

20 DR. STILLWELL: Okay. The methodology is the boards  
21 were taken out. There was a coupon that was associated with --

1 DR. THRALL: No. I just mean once you've got it, how do  
2 you come up with the amount of arsenic that's there?

3 DR. STILLWELL: The amount of arsenic that's on the  
4 surface.

5 DR. THRALL: Right. How are you measuring arsenic?

6 DR. STILLWELL: Okay. After we have the wipe, which we  
7 take on using the block, we have a polyester wiping material. We  
8 go back and forth five times. Once we have this method, we took it  
9 and we used a inductively coupled plasma. Is that what you mean?

10 DR. THRALL: No. I just mean how is it measured. What's  
11 the analytical measurement?

12 DR. STILLWELL: We used ICP. And when it was lower, we  
13 used the graphite furnace. And so our detection limit was in the  
14 neighborhood of .2 to .35 micrograms of arsenic per 100 square  
15 centimeters.

16 DR. THRALL: I know that your explanation for this marked  
17 variability is weather and so on and so forth. But I was just  
18 wondering if it could be something on the analytical side that it  
19 could be because you have all of these low ones at the same time  
20 and then they get high and then they get low and then they get  
21 high. I was just wondering if there could have been some quality

1 control problems.

2 DR. STILLWELL: We don't think so. These are really well  
3 above the detection limit. And we use these controls, ICP 19 and  
4 things like that. But there is no standard reference material that  
5 we can do with every run. But we did qualify.

6 In addition to the glass surfaces, we also did some spikes  
7 with the sawdust where we knew how much we'd expect. We'd  
8 dump a little bit of sawdust onto a wipe, and we got a good  
9 recovery that way.

10 DR. THRALL: And then that was going to be my next  
11 question. What are your standards? There are no standards that  
12 are available for this, then.

13 DR. STILLWELL: Not for a residue, no, not like a soil. For  
14 soil there's standard reference materials such as the Montana soil  
15 for arsenic, and, you know, Buffalo River sediment and things like  
16 that.

17 DR. ROBERTS: Dr. Ginsberg and then Dr. Smith.

18 DR. GINSBERG: The dislodgeable data for the depletion  
19 with use, apparently, the five passes and then the rejuvenation is  
20 intriguing. I'm trying to understand the implications of it. Maybe  
21 you can help.

1           These were playscapes -- and the reason that you got into  
2           this whole framework of testing and thought process was because  
3           your playscape data looks lower than your boards that were  
4           weathered without any ongoing contact. So the dislodgeable went  
5           down after five passes then went back up and then you showed over  
6           time it sort of steady stated.

7           Now, these were from playscapes that were -- those five  
8           passes were on controlled boards. But on playscapes, is it your  
9           thought that if you have high activity level, that you'll have a  
10          lower results? And if you were dealing with a playscape in a park,  
11          say, that's frequently heavily used, you'd get perhaps a lower  
12          residue than if this was, say, residential playscape where there was  
13          one toddler playing on it.

14          Do you have any opinion as far as what the implications of  
15          your results are going from the park scenario to a residential  
16          scenario, going from a high, frequently high contact frequently  
17          used playscape to one that just one child plays on, you know, less  
18          hands and feet touching it.

19          DR. STILLWELL: Yeah. I think if you're talking about a  
20          hand, then you're talking about a lot more buffing. And if you're  
21          talking about foot traffic, that was heavily foot-trafficked, then

1       you, also, have the trade-off between -- you're also abrading the  
2       surface every time you go.

3               So my thinking on that right now would be that it's certainly  
4       up for debate. I didn't solve that problem there, unfortunately.

5               But I do think that if you do repeatedly contact the surface to  
6       the point of smoothness, certainly, the amount of arsenic  
7       dislodged by abrasion, just by, you know, microscopic little  
8       sawtooth structures in the wood and so on, that you're not going to  
9       get as many particles certainly on a smooth surface than a rougher  
10      surface.

11              DR. GINSBERG: So which would suggest that a heavily  
12      used playscape would give you a different result than one that's  
13      not as heavily used?

14              DR. STILLWELL: That's certainly possible, yeah.

15              DR. GINSBERG: And unfortunately, in our packet Table 5  
16      didn't come through. I don't know if you could reproject that.  
17      That was the summary across studies of the different dislodgeable  
18      results, dry method, wet method, et cetera. And I just wanted to  
19      understand.

20              Did you have the Consumer Products Safety Commission  
21      data in those 10 data sets? And could you just quickly list the

1 different data sets that go into that table.

2 DR. STILLWELL: Yeah. The dry ones are the Consumer  
3 Product Safety Commission. And I'm passing around the one  
4 Powerpoint slide that came out bleached. Also, on my next talk,  
5 there's are a couple of others that will come out invisible. And I  
6 have the visible ones here.

7 DR. GINSBERG: That one had CPSC in it. And what were  
8 the other data sets? There were 10 groups, 10 studies that make up  
9 the slide. Can you list those so we know what data you complied  
10 in here?

11 DR. STILLWELL: Which one, the vacuum brush?

12 DR. GINSBERG: Sure, if you want to identify which study  
13 is which, that would be great.

14 DR. STILLWELL: I'm taking all this from Table 5 in the  
15 EPA Expo Doc, and they're summarizing. They have a discussion  
16 of the work beforehand and a discussion afterwards. The one --  
17 there are the six groups using wet wipes which is described on  
18 page 31. They go -- example, the first one was the park in  
19 California, followed by the joggers exercise park. So both of the  
20 first two entries there were playscape sort of structures.

21 DR. GINSBERG: We should just refer to the expo.doc or

1        what EPAs already given us, and you've completed everything in  
2        that to summarize this. Is that what you did?

3            DR. STILLWELL: Yeah.

4            DR. ROBERTS: A quick question from Dr. Smith and then  
5        let's move ahead. Dr. Smith and then Dr. Lees.

6            DR. SMITH: Andy Smith. I guess I'd like to come back to,  
7        again, the figures that show your time trend over a two-year  
8        period. And I guess it's similar to one of the other SAP members.  
9        I'm sort of struck by this change immediately after a year or so and  
10       it goes back up.

11           Can you help? Just tell us roughly what the calendar dates  
12       are. You kind of go from 0 to 800. When's summer, spring, fall on  
13       one of these figures?

14           DR. STILLWELL: All the studies started in late spring, if I  
15       remember right. Yeah, I didn't actually summarize the dates or the  
16       time before a rainfall. And I didn't really see any relationship  
17       firsthand between the seasons as of yet. But we haven't really  
18       looked into that exceedingly carefully.

19           There's nothing that really stands out seasonally or after,  
20       you know, like the heaviest rainfall in a month or anything like  
21       that and look at it a week later.

1 DR. SMITH: So at zero, we're starting off at about fall -- is  
2 that correct? -- late fall.

3 DR. STILLWELL: Right. So maybe the first year would be  
4 then you have the -- so the fall would be that ending data. Maybe  
5 the summer would be 600, let's say.

6 DR. SMITH: Uh-huh, okay. All right. And roughly, when  
7 you say "late fall," you're saying roughly around November.  
8 Could that information be provided to us so we have a good sense  
9 of what the seasonality is here in these time courses?

10 DR. STILLWELL: No.

11 DR. ROBERTS: Thank you for your candor.

12 DR. SMITH: We're not used to not getting our way.

13 But, again, did all the coupons start at the same time? So  
14 when you started this experiment, all the wood samples were  
15 started on the same day.

16 DR. STILLWELL: Oh, no, no. The ones for two years, they  
17 were started about a year ahead of time from the other ones. The  
18 Sets 4 through 7 were started about a year later.

19 DR. SMITH: So when we're looking at this figure for  
20 example, we're looking at boards that some of them have been  
21 started at different times of the year than others.

1 DR. STILLWELL: No, the boards -- these two started -- we  
2 started the study with the two by eights. And then within a couple  
3 of months went on to the, what I call, Set 3. And then after about a  
4 year, we developed enough sophistication that we did the Sets 4  
5 through 7 much more systematically.

6 And we've included these in because they actually went on  
7 for two years. But they were the ones we just kind -- the whole  
8 number of boards kind of like evolved over time. We found it  
9 more worthwhile to keep on going with this.

10 DR. SMITH: Okay. So when I look at one of these figures,  
11 all the results, say, for the two by eight CCA-wood average of four  
12 coupons, that is an entire set that began roughly in late fall and  
13 then went on for about two years; is that correct?

14 DR. STILLWELL: Yeah, the two by eights were started in  
15 the spring, like June, and go on for two years if I remember right.

16 DR. SMITH: Okay. Right, right. Okay. Will this  
17 information be with the final report?

18 DR. STILLWELL: Right. I could gather that, and then make  
19 it into a slide. Also, we wound up with so many boards you  
20 couldn't actually sample them all on one day.

21 DR. ROBERTS: One question by -- two questions. Two

1 quick questions. One from Dr. Lees; one from Dr. Freeman.

2 DR. LEES: Peter Lees, Johns Hopkins University.

3 Actually, my question had to do with the apparent  
4 seasonality of the data. And I'd like to congratulate Dr. Smith on  
5 the brilliance of his question.

6 DR. ROBERTS: Dr. Freeman.

7 DR. FREEMAN: Following up on what Dr. Smith said that it  
8 really does look like you've got a seasonal variation there. So that  
9 if you set that up by time of year, you'll see whether those peaks  
10 are always in the same time of year since you have three peaks  
11 there.

12 DR. STILLWELL: I'll look at that, renew that line of  
13 investigation again when I look at the data.

14 DR. ROBERTS: Dr. Stillwell, can we move on and get you  
15 to give us your presentation on sealants?

16 DR. STILLWELL: Okay. The next talk I'm going to talk  
17 about some of our results on the amounts of arsenic and how it can  
18 be reduced by coating.

19 I have some exhibits of nontreated wood which have the  
20 various coatings that I'm talking about which we just placed  
21 outside. And they were weathered for about three and a half years.

1

2 I'll be putting them on the table over there until tomorrow so  
3 you can look at the various coatings. I talked about polyurethane  
4 or acrylic or oil. You'll be able to see what it looks like.

5 What we did is we decided to investigate the effect of  
6 coatings. There was some discrepancy in the literature between  
7 the Consumer Products Safety Commission and the California  
8 study as to whether coatings actually were reducing the amounts of  
9 arsenic that was dislodged from the surface.

10 And so we just did a very quick study using four coatings.  
11 One was a polyurethane, the other one an acrylic, the other one an  
12 oil based, and the other one a Spar varnish. And we coated the top  
13 surface of two by eight boards and did four replicates for each  
14 coating.

15 And the results are shown on the next slide, graphically, for  
16 arsenic. And compared to the precoat value, the amounts of  
17 arsenic dislodged from the surface was dramatically decreased in  
18 the case of polyurethane, acrylic, and varnish, and also  
19 substantially decreased in the case of the oil finish. And the  
20 actual numbers are shown on the next slide.

21 Here, some of these numbers are actually below the

1 detection limit. I took this to graph the data. The detection limit  
2 is between .2 and .5 micrograms of arsenic per hundred square  
3 centimeters. That works out to be approximately two to five parts  
4 per billion in the furnace.

5 You can see that, compared to the precoat number, there was  
6 a substantial decrease all across the board.

7 And on the next slide here, I'm going to show some of the  
8 problems with the oil coating or other coatings that may be not as  
9 effective as the polyurethane or the acrylic. You can see that I'm  
10 comparing the precoat to some other post-coat values. But we also  
11 saw, before, that the amounts are variable. So there was no  
12 side-by-side comparison done.

13 So if you look at maybe a board, 3.3, that yellow entry after  
14 day 365, if there was a good side-by-side comparison, maybe the  
15 amount of arsenic dislodged on an uncoated might have been 5 as  
16 well or it might have been 10 or 15.

17 This is one of the problems with this particular study is that  
18 I didn't exactly was able to have any sort of uncoated control that I  
19 could follow in any reliable manner over time. So the reduction  
20 with the oil coatings are more uncertain than the others.

21 But nonetheless, in the next slide, the amounts of chromium

1 dislodged from the surface also exhibited the same behavior and is  
2 also tabulated on the next viewgraph here.

3 Pretty much the same numbers. Again, there was error here.  
4 This was taken to make the graph. And the detect limit there is 0.5  
5 micrograms. Some of these are actually below the detection limit.

6 So the conclusion for this study is that we found that these  
7 materials reduce the amount of arsenic dislodged from the surface  
8 with the oil-based finish being less effective than the others.  
9 However, the oil base wears uniformly and doesn't chip or peel  
10 away and may be preferable for foot-traffic surfaces.

11 The problems with this is that we should be able to have a  
12 side-by-side comparison and maybe do different types of coatings.

13 On the next slide here, the Spar varnish after one year, it  
14 deteriorated pretty significantly. I have an example of it. I don't  
15 recommend Spar varnish for any reason whatsoever. It doesn't  
16 hold up for time, and it visually just really, really falls apart. Not  
17 to mention the fact that it's fairly slippery so you wouldn't want to  
18 use it for foot-traffic areas anyway, and it's not sold that way.

19 What you use it for would be for horizontal surfaces.

20 I have also the Consumer Reports June '98 and '99 study on  
21 exterior deck treatments.

1           On the next slide, the Consumer Report study and this study  
2           which was something that was alluded to earlier, they look more at  
3           the performance on the finishes. And there is a general agreement  
4           that a fully pigmented finish will last longer than a  
5           semitransparent which lasts longer than an unpigmented or clear  
6           coat. And the stains need refinishing after two years or less. And  
7           paints could hold up for more than two years.

8           But my experience on porches and so on, any sort of foot-  
9           traffic area, two or three years would be about it. And these are  
10          some of the general guidelines.

11          On the next slide, here are the results of the California  
12          study. And they were pretty much in agreement with what I found  
13          in that their polyurethane reduced the amounts of arsenic  
14          dislodged quite dramatically. And the oil base was less effective.

15          The Consumer Product Safety Commission study is shown  
16          next. And here they compared no coating to oil based to water  
17          based. The water based, we know, is pretty much the same now as  
18          the water-repellant board. And I don't think the water repellants  
19          have any barrier to arsenic or very little barrier to arsenic.

20          The oil based, I don't know why they had higher numbers and  
21          so on. It may be problems with the matching, and it could also be

1       due to using a different oil-based stain than what I used. There  
2       may be a lot of difference in the effect between different oil bases.

3             And on the next slide, this is kind of like a summary here.  
4       There's indication by Riedel in that document, the final Expo  
5       document. They have mixed results with coatings. Lebow and  
6       Evans had no success at all. The Consumer Products Safety  
7       Commission didn't. And California and the work that I just  
8       described, we felt that coatings did work.

9             Lebow and Evans actually did something very interesting  
10       there where they used iron oxide and acrylic before the pressure  
11       treatment and didn't find any effect for reasons that I don't really  
12       know about. But the idea of an iron oxide primer is very  
13       interesting because you can form the insoluble iron arsenate right  
14       there on the surface. And I wonder if you put a iron oxide primer  
15       on beforehand, that might just work really well.

16            So on the last slide here, it would be good to focus on the oil  
17       based, acrylic, polyurethane. And there's the speciality coatings  
18       that you find on the internet like Weather Boss and things like  
19       that, and they're based on linseed oil and other things. And they  
20       may work, for all I know.

21            But the real comparison would be to use more in the way of

1 environmental test chambers to real weathering applications which  
2 would have to include wear and tear, foot traffic.

3 Thank you very much.

4 DR. ROBERTS: Are there any questions? I see several. Dr.  
5 Mushak, and we'll go from there.

6 DR. MUSHAK: Yes. A question about peeling and chipping  
7 of these coatings. What happens when they come off? Because,  
8 clearly, when you put the coating on, you essentially embed the  
9 dislodgeable film into whatever you're coating with. And I'm  
10 concerned that when this starts peeling, we're back to the old  
11 peeling paint and peeling stains business with childhood exposure.

12

13 Isn't it possible that in one sense you can get more intense  
14 exposure when these things start falling apart then say if a child  
15 touches repeatedly, getting small amounts? Is this a hazard, I  
16 mean, once it starts deteriorating?

17 DR. STILLWELL: The paint chips themselves, if they're  
18 nontoxic, I don't think they'd be a hazard. But I think you mean  
19 like if there is a chip and what you might have is you might have  
20 some concentrated areas of arsenic right in the interface.

21 DR. MUSHAK: Yeah.

1 DR. STILLWELL: Right.

2 DR. MUSHAK: If you have a film of dislodgeables and then  
3 put a coating over it, the film of dislodgeable is going to embed  
4 into that film of coating. And when that solidifies, it seems to me  
5 that that whole dislodgeable layer would come off at this time,  
6 chip or the paint.

7 I'm quite convinced that there's no toxic matrix in the  
8 coatings that would be a problem. I think the fact that they can  
9 pull off a layer of dislodgeables and give a very intense bolus of  
10 exposure of a child has to be taken into account.

11 DR. STILLWELL: That's an interesting idea. And I'll,  
12 maybe one of these days, test a paint chip and see what happens.  
13 Certainly that brings up a point that if you do coat it -- coated it  
14 with a solid polyurethane, acrylic, or an epoxy -- and you do that  
15 at a municipal playground, that if you don't maintain it, it's going  
16 to chip, it's going to peel, and it's going to flake, and it's going to  
17 look awful. That's the argument for oil based is that it kind of  
18 uniformly wears.

19 And that's one of the reasons why you have to be careful  
20 with the solid colors. You're stuck with them. And then if you do  
21 want to get rid of them, you have to use paint strippers and so on

1 to get rid of them.

2 DR. ROBERTS: Dr. Francois, then Dr. Smith, and Dr.  
3 Wargo.

4 DR. FRANCOIS: Looking at the list of coatings that you've  
5 listed, are you aware of any coatings that are compatible enough  
6 that they're used together on these surfaces?

7 DR. STILLWELL: The material we used, they were  
8 formulated for use on pressure-treated wood, with the exception of  
9 the Spar varnish, which we just went to a paint store and asked,  
10 said, we want to paint some pressure-treated wood. What do you  
11 got?

12 The other ones, the Olympic, it says for immediate use on  
13 pressure-treated wood. So these are formulated for those sorts of  
14 applications.

15 DR. FRANCOIS: No, I mean using two coatings together.

16 DR. STILLWELL: Yes, I did two coats.

17 DR. FRANCOIS: No, two coats of different materials, using  
18 two different coatings.

19 DR. STILLWELL: Oh, no, no, no.

20 DR. FRANCOIS: Are any of these coatings compatible  
21 enough to be used together? For example, the oil based with the

1 polyurethane, did anybody look at that?

2 DR. STILLWELL: You can put some of these on top of the  
3 oil based. But once you have the solid ones, you're pretty much  
4 stuck with it. And that's a problem that, for each particular type of  
5 coating, you have to be careful with. Because some coatings, once  
6 you put on an acrylic, you can put on more acrylics. Once you put  
7 on certain enamels, you can't just start putting on other types of  
8 coatings.

9 So, yes, again, we should probably be fairly careful in  
10 recommending certain coatings and things like that without  
11 knowing. The compatibility is a good issue, too.

12 DR. ROBERTS: Dr. Smith.

13 DR. SMITH: Thank you. Andy Smith.

14 Three questions. First, I want to make sure I understand the  
15 design again. We start with four boards. We take four boards.  
16 Each boards is split into 4 coupons, total of 16 coupons. How are  
17 you assigning the individual coupons to treatment? Is it all  
18 coupons from one board goes into treatment A, and all coupons  
19 from Board 2 goes into treatment B; or are you randomizing boards  
20 to treatment?

21 DR. STILLWELL: I'd have to look back and see what we did

1 on that on the two by eights. Since we were coating them, we were  
2 probably just interested in the precoat and postcoat numbers. And  
3 I don't remember taking any particular care one way or the other. I  
4 think we just grabbed some.

5 DR. SMITH: Just somewhat of interest, given your sort of  
6 between-board variability to know that. So it would be helpful to  
7 us to know more about that.

8 The second question is: It looks like your control is  
9 essentially the board itself, the same board. So you would sample  
10 the board at time zero, then you would treat the board, and then  
11 follow that board over time; is that correct? There's no coupon  
12 that is sort of untreated with this group and being looked at over  
13 time; is that correct?

14 DR. STILLWELL: Right. Yes, that's a problem.

15 DR. SMITH: Is this going on along the same time as your  
16 other studies and the boards coming from the same sort of places  
17 so that we might be able to appeal to some of your other data that  
18 you showed us earlier to give us some sort sense of what we would  
19 expect to be the behavior of the board over time?

20 DR. STILLWELL: We might be able to do that. But,  
21 unfortunately, it was with the two by eights which had just the

1       very high within-board variability and so on. I'd rather just do the  
2       study over again with something much better characterized and,  
3       also, expand it. Actually, do it in a different geography, the south  
4       versus the north and, you know, maybe five types oil based.

5             And I think there's general agreement that if you form a  
6       solid polyurethane just impervious barrier, I mean, you've got to  
7       stop the arsenic. But the oil based is a little bit more problematic.

8             DR. SMITH: Have you had any thoughts about contacting  
9       Consumer Reports, given their ongoing work, as to whether or not  
10      you might get them to entertain doing some arsenic wipe samples  
11      combined with their other studies of looking at the performance of  
12      these various treatments?

13            DR. STILLWELL: No. But that's a good idea.

14            DR. SMITH: And do you still have these coupons that have  
15      been treated?

16            DR. STILLWELL: Yes.

17            DR. SMITH: You stopped the study at one year. So I'm  
18      curious whether you still have these coupons. Are they out in the  
19      field, or where are they? I guess some of them are right here.

20            DR. STILLWELL: Most of them we've taken inside after a  
21      certain amount of time. And we never did resample them. You can

1     argue, well, it will only take a few minutes to resample one. But  
2     then if you find something and it doesn't make sense, then you're  
3     stuck with it. And you might have to do it again and again and  
4     again, which is actually what happened to this study to begin with  
5     anyway. I didn't really plan on getting this extensive.

6             DR. ROBERTS: Dr. Wargo.

7             DR. WARGO: It's been asked. Thank you.

8             DR. ROBERTS: Dr. Styblo.

9             DR. STYBLO: You said you haven't done any chemical  
10     speciation analysis in this particular study. Do you have any data  
11     that would give us any idea about arsenic species in this type of  
12     material?

13            DR. STILLWELL: No. It's generally accepted, or at least I  
14     thought it was pretty much accepted, that the arsenic, when it  
15     comes out of the wood though, is inorganic arsenic in the  
16     presumably plus-V state. And I think that's pretty much well  
17     established.

18            DR. STYBLO: I think it's accepted not so well established.

19            DR. ROBERTS: Let's take two more questions, one from Dr.  
20     Solo-Gabriele and one from Dr. Ginsberg. And then let's move on  
21     to our next presentation.

1           DR. SOLO-GABRIELE: I have one question. You have the  
2           comparison of different studies here: Your work, California,  
3           Riedel, and so on. You have a yes, yes, mixed, no, no. So it's split  
4           right down the middle.

5           Do you have any insight or hypothesis as to why these  
6           different studies give different results?

7           DR. STILLWELL: Yeah, they used different coatings and  
8           different methodologies in their tests. The one that was mixed,  
9           they were comparing structures that were recently stained or not  
10          stained or stained a long time ago. So it was more empirical in  
11          comparing it to maybe other structures that were nearby. And it  
12          wasn't really like a direct coating sort of experiment.

13          And the other one with the iron oxides and the acrylic, I have  
14          no idea why they weren't successful. That's a very good idea.

15          DR. SOLO-GABRIELE: Did they only test the iron oxide  
16          and the acrylic in that study, or were there other sealants?

17          DR. STILLWELL: Iron oxide, they said there was no  
18          success.

19          DR. SOLO-GABRIELE: In Lebow and Evans, were there  
20          other sealants evaluated?

21          DR. STILLWELL: Yeah.

1 DR. SOLO-GABRIELE: Yes. And they still had negative  
2 results in the Lebow.

3 DR. STILLWELL: Yes.

4 DR. ROBERTS: Dr. Ginsberg.

5 DR. GINSBERG: Just to follow-up. This wasn't what I was  
6 going to ask but just to clarify the point that was just raised.

7 The Lebow study, that was with a pretreatment of the wood;  
8 is that correct?

9 DR. STILLWELL: Right. This is the pretreatment. This is  
10 described in your final expo.doc, the treatment that was done by  
11 him.

12 DR. GINSBERG: Yeah, I think I understand your studies  
13 fairly well. Just a couple of points I want clarified.

14 Did you have a waiting period before you coated these  
15 boards? Did you follow the 30-day recommendation that we heard  
16 earlier today before you coated the boards?

17 DR. STILLWELL: We did on two on half the boards, I  
18 believe, was our protocol. We took some that were weathered for  
19 30 days. And now that I think about it, yes. We had some that  
20 were weathered and some that weren't weathered.

21 And we also did some -- there really didn't seem to be any

1 difference or any effect. Of course, we didn't subject it to any  
2 harsh circumstances other than the weather.

3 The Olympic stain, if I remember right, I know one of them  
4 is for immediate use on pressure-treated wood. And I, also, have  
5 this example. This is coated on water-repellant boards. And the  
6 results were pretty similar. They'd adhered as well as anything  
7 else. But that would be a factor for an expanded sort of study.

8 DR. GINSBERG: And if you would just clarify this: Did  
9 you make a point of testing, with each sequential time point  
10 testing, a different part of the board or a different coupon; or did  
11 you go back in your time-core study and sample the same piece of  
12 board?

13 DR. STILLWELL: Just the coated board.

14 DR. GINSBERG: So you swiped the same area.

15 DR. STILLWELL: Right.

16 DR. GINSBERG: Over time.

17 DR. STILLWELL: Yes, it was only a very small area that we  
18 coated.

19 DR. GINSBERG: So then is it possible that your precoat  
20 versus postcoat difference could have been due to depletion of the  
21 surface residue?

1 DR. STILLWELL: Due to depletion?

2 DR. GINSBERG: Yeah, if you sample the same. You  
3 showed before with five passes, you could deplete what's there.

4 DR. STILLWELL: Oh, right. Yes.

5 DR. GINSBERG: So is it possible that your precoat versus  
6 postcoat difference could be not due to a surface barrier but due to  
7 depletion of that spot?

8 DR. STILLWELL: Yes. But the polyurethane and acrylic,  
9 they were so far successful. Yes, when we did a -- yeah, that's  
10 another point. We do the precoat. Yeah, you're certainly reducing  
11 the amount there.

12 And so if you're looking into things like the oil based, which  
13 has more of a marginal type effect, I think we have to be more  
14 careful in the interpretation there. And I'm kind of -- certainly  
15 that data is the most uncertain. But when you get down to the  
16 polyurethane and acrylic, you're below the detection limit for the  
17 most part.

18 DR. GINSBERG: And just to clarify. It was an N of 1 in all  
19 of your time core data. Except for the precoat, you have standard  
20 error for that. Everything else is just a single data point.

21 DR. STILLWELL: I believe so, yeah.

1           DR. ROBERTS: Thank you very much for sharing your data  
2           and answering our questions regarding it.

3           I would like to do one more presentation before we go to  
4           break. Our presentation next is on soil residue data by Dr.  
5           Timothy Townsend from that distinguished academic institution to  
6           the south.

7           DR. TOWNSEND: Good afternoon. And I'd like to thank the  
8           Panel for the opportunity to come and speak.

9           My name is Tim Townsend. I'm an Associate Professor in  
10          the Department of Environmental Engineering Sciences at the  
11          University of Florida. My area of specialization is solid and  
12          hazardous waste management.

13          I'm a solid waste engineer. I'm not a toxicologist. I'm not a  
14          wood preservative scientist. So I'm going to share some  
15          perspectives that our research team has gathered with regard to  
16          CCA-treated wood issues.

17          Although we got into it from the disposal standpoint, a lot of  
18          the exposure issues have come up recently so we have been doing  
19          some research in that area.

20          I just want to make the note that the research that I will be  
21          presenting is primarily funded by an organization called the -- I

1 see everybody looking around. I'm afraid you do not have  
2 anything from me in your package. There's a CD there now if you  
3 were to so choose to make copies.

4 DR. ROBERTS: Yeah, we'll have handouts prepared then  
5 and distributed to the Panel.

6 DR. TOWNSEND: Thank you.

7 The Florida Center for Solid and Hazardous Waste  
8 Management, which is located at the University of Florida. And  
9 then the investigators in our research team, being Helena  
10 Solo-Gabriele from the University of Miami and myself from the  
11 University of Florida. Next slide.

12 Objectives. Review some current information about arsenic  
13 chromium primarily, a little bit about copper concentrations in  
14 soiled underneath CCA structures.

15 What I would like to do is -- in addition to what EPA asked  
16 me to review for you, was our research as well as some other  
17 research studies on the soil residue data.

18 What I would like to also do a little bit in the beginning is to  
19 talk about the concept of leaching and the migration of these  
20 metals from treated wood because it has been raised in a number of  
21 issues along the way, a number of questions throughout the past

1 day or so.

2       So I'd like to bring up and show you some data that's been  
3 collected by ourselves and others. And a lot of this is not data sets  
4 that are intended to be used as part of this exposure assessment but  
5 merely to illustrate some points that I think, as you go and  
6 deliberate and make some decisions, will help you understand a  
7 little bit better about what's going on when this material is  
8 leaching from the wood.

9       Then we do have a little bit of information on speciation  
10 which we're in the middle of in our laboratories right now that  
11 we'd like to share with you. Next slide.

12       So in terms of contamination of soil from CCA-treated wood,  
13 if you think about the different mechanisms -- and Dr. Stillwell  
14 brought this up a little while ago. But debris from construction,  
15 the potential that as you build a playscape or a deck that you were  
16 to saw that material right there and you would have sawdust that  
17 was not cleaned up as recommended by the manufactures and was  
18 left there into the soil, it would certainly add to that burden of  
19 heavy metal.

20       Abrasion of wood particles from wood surfaces. In other  
21 words, if you have little children stamping their feet and if they're

1 getting sand on top of that and abrading that, it is certainly not  
2 uncommon to go to a structure and see the wood screws that were  
3 put in there and now protruding up from above the wood and that  
4 the wood has actually ground down over time.

5 And then leaching of metals from the wood into water, being  
6 rainwater passing over that and then into underlying or adjacent  
7 soil. And that's really the primary mechanism that I'll discuss for  
8 you right now.

9 The top two are things that there really is not any specific  
10 information on that we can present, although I think it's just  
11 important for you to understand that these are potential sources.  
12 Next slide.

13 So we've been talking this term "fixation" throughout the  
14 past couple days. And again, CCA metals are fixed to the wood  
15 during this treatment process, and I will talk a little bit more about  
16 some of the chemistry of fixation and try to answer a few questions  
17 in a latter slide.

18 The thing that we've learned is that even though things are  
19 fixed, these metals are fixed to the wood, they are still relatively  
20 water soluble.

21 Now, when I say "relatively," when you were looking at the

1 issue of depletion of metals from preserved wood in the past from  
2 a wood preservers standpoint, you were interested in keeping as  
3 much metals in there as you can, to keep the efficacy of the wood  
4 in place.

5 In the literature if you go back and read, if you had  
6 90-percent retention of your metals in the wood, that was a pretty  
7 good thing. But you would still have a good viable product that's  
8 functioning. So something that was 10 percent or less being lost  
9 was not considered an issue with respect to depletion and how well  
10 the wood performed.

11 But when you start looking at that 10 percent with respect to  
12 some of the environmental issues which bring to the surface later,  
13 then you can see that even a small amount of material leaching can  
14 have some potential impact in terms of elevated concentrations.  
15 Next slide.

16 As a reminder about concentrations, one thing that is  
17 oftentimes confusing is that the wood industry uses units in terms  
18 of pounds per cubic foot. So you are going to see when you buy  
19 wood, or you've seen some of the presentations already, PCF .2  
20 pounds per cubic foot, referring to .2 pounds of the CCA chemical  
21 in a cubic foot of wood, where .4 pounds per cubic foot.

1           Since I deal -- and a lot of you deal -- with concentrations  
2       such as parts per million in a soil or waste or in a water, just to  
3       give you some perspective, it's about 1,700 hundred milligrams per  
4       kilogram of arsenic in the wood for .25 and about 2,000 for the  
5       chromium. Then if you go to .4, of course, it increases  
6       concomitantly after that. Next slide.

7           In terms of -- I would like to give you some perspective so  
8       that as you begin to think of these issues how much should you  
9       really expect to leach. How much of that arsenic or that chromium  
10      or copper that's originally in the wood would you expect to leach  
11      over time.

12          If you go to the literature and begin to look at some of this  
13      information, one thing that you will encounter right away is that  
14      there are a number of different ways where this is measured, and  
15      it's oftentimes done looking at different scenarios than we're  
16      talking about here.

17          One of the big sources of literature is going to be from the  
18      industry data where they go out and they have a piece of wood  
19      that's buried in soil somewhere or there's a deck built out in a  
20      particular area and they measure retention loss over time.

21          A lot of studies are looking at aquatic toxicity. In other

1 words, if you're going to have CCA pilings or bulkheads in a water  
2 body, how much is going to leach off that. So you have a lot of  
3 studies where water and the material is submerged in water.

4 There are a few cases where you'll have studies where you  
5 try and simulate rainfall over those although those are more out in  
6 the field and aren't anywhere as numerous as the studies being  
7 done in submerged in water.

8 As a waste engineer, one thing we do all the time is we take  
9 wastes and we leach them. And that's typically done in some kind  
10 of batch test. And some of you have heard of a term called the  
11 "TCLP," which is the toxicity characteristic leaching procedure.  
12 It's just a test that you use to leach elements or chemicals out, and  
13 it's used in regulatory terms for regulatory reasons. Next slide.

14 Now, whenever we talk about leaching -- and EPA and the  
15 Office of Solid Waste had their own science advisory board or  
16 panel on just the issue of leaching itself when you talk about solid  
17 waste in contaminated soils. But we've already heard about woods  
18 type and the way it was treated having a very, very big impact.

19 The type of leaching solution -- of course, we're dealing  
20 with rainwater here and all the data I'll present today deals with  
21 rainwater or simulated rainwater. But if you have salt water, it

1 might leach differently than if you had rainwater versus if you  
2 had, say, a water that had high organic carbon content.

3 The pH we've already discussed in here. I'd like to shed a  
4 little bit of light on what you would expect to leach as a function  
5 of pH, the size of the particle. You can see a lot of the studies that  
6 I -- or some of the results I present for illustrative purposes are  
7 done on size-reduced materials because that's typical of how you  
8 do leaching tests in the lab. So you have to always kind of keep in  
9 the back of your mind particle size as being an issue of  
10 importance.

11 Exposure time. How long the wood is exposed to the water.  
12 And then this list isn't meant to be all encompassing. But another  
13 one, microbial action, if you have wood that is buried in the soil  
14 and you have these organisms that are acting on that, the amount  
15 that leaches and moves from the wood should be different or at  
16 least will have some impact because of that.

17 And real quickly, some reports will give milligram per liter  
18 in terms of what the concentration is in your leachate as it leaches  
19 away. Others will give it in terms of the percent left in the wood.

20 And what I've tried to do as much as I can is to go back and  
21 connect data that I had in milligrams per liter, which is what we're

1 use when we're trying to do assessments for this regulatory  
2 applications, and put it all in terms of percent remaining or  
3 actually percent leaving the wood. How much arsenic or chromium  
4 has left the wood in a given leaching test. Next slide, please.

5 This slide right here simply reports the results of a number  
6 of field depletions studies. These are compiled from a number of  
7 different industry reports. And you see Hilo, Hawaii; Gainesville,  
8 Florida; happens to be the location of test sites. Bainesbridge,  
9 Georgia.

10 So I selected some of these. I apologize. The purple bar  
11 represent arsenic, and the kind of the light green bar represent  
12 chromium. And these are not necessary meant to represent how  
13 much would leach from a deck or a playscape as rain was falling  
14 over it. These are fairly aggressive tests to see how much of the  
15 chemical, arsenic or chromium, would leach from the wood.

16 And just to give you some perspective, you can see a range  
17 of anywhere from maybe 15 up to 45 percent of the arsenic would  
18 leach out under these very aggressive tests where they're bearing  
19 stakes and soils or where they have materials that have been set  
20 out in a very humid, very moist environment where you'd expect to  
21 have a lot of deterioration.

1           And the purpose of these tests are really to determine how  
2           well the chemicals and the structure and the efficacy of the  
3           material holds up over time. I do want to make the point, and Dr.  
4           Stillwell made it a little bit earlier, is that chromium tends to  
5           leach less than arsenic. And we'll address that again.

6           And you can see chromium leaching from really -- no  
7           reported leaching up to maybe 20 percent. So again, these are  
8           field tests to start to give you some idea of magnitude. Next slide.

9           Now, what I'd like to show you next are going to be some lab  
10          tests. And there's a test that's kind of similar to the TCLP. It's  
11          call the "SPLP," synthetic precipitation leaching procedure. It's a  
12          rainwater test. You take a simulated rainwater. You leach it. You  
13          add a 20-to-1 liquid-to-solid ratio for 18 hours. It's rotated end  
14          over end, and then you filter it and analyze what's in the leachate.

15          The test prescribes that you do this on a particular size-  
16          reduced basis. In other words, you take materials and grind them.  
17          But I'll show you some results in a moment where you can do it on  
18          entire pieces of wood, not necessary two by fours, but not ground  
19          up either. Next slide.

20          So here are some SPLP results for new CCA-treated wood  
21          samples purchased from local home improvement stores in Florida.

1 The green, again, represents arsenic, and the red represents  
2 chromium. And the error bars that you see really just represent a  
3 min and a max in terms of the these different samples to give you  
4 some idea of the range.

5 The point is, if you just leached one block of wood that was  
6 the size that you needed for the particular test, SPLP, which is 100  
7 grams for 18 hours, you see about 1 percent of the arsenic leaches.

8 Now, it ranges from the type of wood. If you grind it up and  
9 have sawdust, you'll have anywhere from 1 percent up to 8 or 9  
10 percent might leach out of that wood. Chromium, again, leaches  
11 less.

12 So probably the main point I offer for you, a few points,  
13 number one, arsenic leaches more than chromium. Particle size is  
14 very important. The larger -- I guess, it would be the more surface  
15 area available, the more leaching you're going to have. So the  
16 larger the particle size, the less leaching that you'll tend to see.

17 And, also, if you notice, that range in those error bars, which  
18 again are just min and max. One point that I would really stress to  
19 everybody is that one piece of CCA-treated wood goes -- you look  
20 at another piece of CCA-treated wood, you might have completely  
21 different results.

1           In terms of when you accept this .25 pounds per cubic foot  
2           that you see on the label, in my mind when I see that, that means to  
3           me .18 to .35 or something like that. So there's a big range.

4           And I've heard others who are wood preservation scientists  
5           report similar results. And you can find that in the same piece of  
6           lumber. Because if you go through a certain spot that has a lot of  
7           hard wood versus soft wood, you just get different penetrations  
8           and you get different amounts of material that will leach. Next  
9           slide.

10          Well, we've talked about the impact of pH. And I went ahead  
11          and converted this over to percent leach. I didn't have time to  
12          keep the error bars in. But here you see the new CCA-treated  
13          wood. It was purchased as .25, and the analysis using XRF was  
14          .21. So that's not an uncommon thing to find.

15          Look at the green line. And, of course, this is percent  
16          leached as a function of pH. And it's a fairly typical curve that  
17          you see for a lot of different types of metals. And at neutral  
18          conditions, you're seeing around 35 percent or so of the arsenic  
19          leach.

20          Now, this is, again, using a size-reduced material.  
21          Remember we saw on the one previous slide maybe 4- or 5-percent

1 leaching. And this is a simulated rainwater. So we're taking a  
2 simulated -- well, we adjust the pH. So we take DIs and then to go  
3 to a higher pH, we use sodium hydroxide. To go to a lower pH, we  
4 use nitric acid. It's something that's used in the waste industry to  
5 characterize waste fairly frequently.

6 But just notice that a pH of 2, we're talking around 45  
7 percent or so of the arsenic leaching. If you'll see around a pH of  
8 4 to 5, you're talking anywhere from 6 to 12 percent.

9 I would say that it's really -- when you talk about what the  
10 pH that you are going to encounter on the wood, even though you  
11 might have rainfall, depending on the rain conditions, the wood  
12 itself, the pH of a solution in contact with the wood, is typically  
13 going to be around a 4.5 to 5. So that will typically end up being  
14 what the pH is at the exposure site as this material passes over.

15 And here you can see, again, chromium behaving in similar  
16 manner but again less material leaching.

17 Next slide is a similar, not quite, of robust data set and  
18 probably we will redo some of this. This is for an old playground  
19 that was torn down.

20 So I wanted to show you the fact that you take material that's  
21 -- now this is size-reduced, so you're getting into the middle side

1 of that wood, that wood material as a whole, not just the surface  
2 material but the entire material, again, displays a similar pattern.

3 This one actually leached a little bit more chromium at the  
4 lower pHs. But toward the neutral ranges, arsenic tended to leach  
5 more. And, again, this was .39 pounds per cubic foot as kind of  
6 being an average retention value. Next slide.

7 Let's talk about time for a second. Because one thing that I  
8 thought was interesting and worth you noting is that -- this is a  
9 test we ran, that SPLP, which again is a rainwater leaching test,  
10 and we took some ground-up CCA-treated wood. And this is new  
11 treated wood.

12 And what we did is conducted a whole suite of SPLPs, but we  
13 took them off at different times. We allowed them to leach for  
14 different lengths of time.

15 And just notice that 18 hours is the point where we take off  
16 the traditional SPLP test. But if you notice, the amount of arsenic  
17 that continues to leach off over time. In other words, the arsenic,  
18 it's not some instant solubilization into the leaching solution, that  
19 there is a migration from the wood itself into the solution.

20 And as you deplete the surface of that wood particle of that  
21 arsenic, then you have this gradient of greater arsenic

1 concentrations in the center moving out toward the leaching  
2 solution. And so you begin to see increased concentrations.

3 Also, note the difference. You know, it differs from woods  
4 species or from different types of treated wood. But arsenic,  
5 again, is much greater than chromium. And for those of you  
6 interested in copper, copper would fall just a little bit above the  
7 chromium line in this particular example.

8 So this is wood being exposed at different lengths of time.  
9 But you're not necessarily going to encounter that a whole lot at a  
10 playscape. You're going to typically have the water pass through  
11 and then you'll get new water exposed to it on soil.

12 So on the next slide is another set of time results. And here  
13 they are for blocks and chipped wood. And this is where you leach  
14 it.

15 So you look at that bottom line. You leach a block of wood.  
16 And the next day, you drain that leachate; and you put all new  
17 fresh rainwater in there and you leach it again. And you do it  
18 again, and you do it again. And what you see in this case, is that,  
19 by the time you get up to 10 days or so, we've leached 6 percent.  
20 But it's still increasing. It's that slope of that bottom line is  
21 relatively linear. And what you're finding is the concentration in

1 your leachate on day 8, 9, and 10 is about the same.

2       So the point I would make is that, yes, that when you do have  
3 a playscape or CCA-deck and you have rainfall coming over it, you  
4 are going to get your largest amount of chemical leached in the  
5 beginning. But then you have continual smaller amount leached  
6 over time.

7       And I don't know that the chemistry and the experiments  
8 have ever been done to document this in great, great detail. But  
9 you can kind of develop a model in your mind where, as this  
10 material is washed from the surface of the wood at different ratios,  
11 you have chemicals from the inside of the wood that begin to  
12 migrate to the surface. And you continue to have this leaching  
13 process. But it is fair to say that you get probably the greatest  
14 dose in the beginning. Next slide.

15       So in your exposure document, I think somewhere they go  
16 and they say, in terms of what metals leach more, it depends on  
17 what source you look at. Sometimes it's copper is greater than  
18 arsenic is greater than chromium. That's true for low pHs.  
19 Because as soon as you get to a low pH, copper really starts to  
20 come off.

21       But really, all the results that we've done at the typical pH

1 of rainfall, arsenic leaches the most followed by copper and then  
2 chromium the least. Next slide.

3 So kind of my purpose in that is just to kind of give you  
4 some familiarity with what happens with respect to these metals  
5 leaching from the wood because that's then in turn what gets into  
6 the soil or, as we'll talk later, into these buffer materials  
7 underneath the structure.

8 So what I was asked to do by EPA was to review, briefly,  
9 some of these studies that have been conducted.

10 So with the next slide, I'll talk about a study. And this is  
11 something that Dr. Stillwell and his colleagues conducted.

12 This was a study with seven decks, a total of 85 soil samples.  
13 And you can see the note that all but -- none of them were coated  
14 with paint or stain except one. You had a series of control samples  
15 which were taking away from underneath the decks. We had soil  
16 samples collected from underneath the deck. And then you had  
17 soil samples collected away from the deck to try and get some idea  
18 of background concentration.

19 So if we look at the next slide, here are the seven decks.  
20 And this information and data is all in your document, to give you  
21 an exact page, 38, in your exposure document. So this is just

1 information taken from there and, of course, Dr. Stillwell's  
2 publication.

3 But you can see the mean concentration for these. And this  
4 is for arsenic beneath these series of decks range from 9 up to 130  
5 with an overall average of 76 milligrams per kilogram. If you look  
6 at control samples, you can see they were all in the range of 2 to 5  
7 or so.

8 So the next slide will kind of give an idea of all three  
9 metals. Again, you can see the arsenic concentration on the far  
10 right. The under the deck is the yellow bar, and the green bar  
11 represents the control samples. They were statistically different  
12 at every site.

13 You can see the chromium and the copper also demonstrated  
14 elevated concentrations above background. Notice that copper and  
15 chromium in these areas had higher naturally occurring  
16 background in the soil.

17 If you go back to remember what is the concentration in  
18 CCA-treated wood, there's a little bit more chromium than there is  
19 copper in terms of the overall concentration. Chromium is more  
20 abundant. But as you notice in this case, you see more arsenic in  
21 the soil than you do see chromium.

1           And what Dr. Stillwell was able to point out the fact is that  
2           the numbers are high. And there's been some criticism that, well,  
3           these are just representative of perhaps sawdust or something like  
4           that underneath the deck. But you would tend to see things a little  
5           bit more in comparison between the chromium and the arsenic  
6           where the chromium would tend to be close to the arsenic or  
7           perhaps a little bit higher. So, again, this is one of the data sets.

8           Let's look at one more, please. In a Florida study -- and this  
9           is what was done by our research team -- a total of 73 soil samples  
10          collected under nine treated-wood structures. Some of them were  
11          decks, some of them were kind of like footbridges and walkways.  
12          I'll show you a few pictures in a moment. And then control  
13          samples, an equal number were taken from areas next to those  
14          structures, anywhere from 50 to 100 feet away. And then collected  
15          soil samples from up one inch of soil. And, also, at each site, we  
16          collected a core.

17          So if we look at the next slide there were three cities. We  
18          did it in Gainesville, which is kind of the center of the state. And  
19          you can kind of see some footbridges or walkways. Next slide.

20          This is down in Miami. You can see a lifeguard stand, a  
21          couple more treated-wood structures in parks. Next slide.

1           Then up in Tallahassee, which is the in the panhandle of  
2           Florida, again, typical examples of what we sampled from.

3           Now, I will say that we did not look at playgrounds as part of  
4           this study. We were looking at CCA-treated structures. Next  
5           slide.

6           Just formed a simple grid when we were out there. Our  
7           objective was to collect eight samples. So we'd form a grid of a  
8           particular section of this deck or walkway, and then we would  
9           sample from those grid sections. Next slide.

10          Also collecting a core sample which you see there in the  
11          center being collected. Next slide.

12          And then, of course, one of the things we wanted to do was  
13          to make sure that what we were sampling was really a CCA-treated  
14          wood deck. So there were some stain tests that we were able to use  
15          as well as to collect some borings that we could take back and do  
16          XRF or chemical analysis to get some idea of what the retention  
17          value was because, in most cases, you simply don't have the  
18          original specifications available for you in terms of what it was  
19          made of or what the concentration was. Next slide.

20          I just wanted to make the note real quick that it turns out  
21          that, when we got all the information back, there was one site

1 where the arsenic underneath the deck was not statistically  
2 different than the control sample.

3 So what we did is went back and resampled and, again,  
4 checked to see if the deck was actually CCA-treated wood. And it  
5 turned out it was not a CCA-treated deck. So our data set then of  
6 CCA-treated structures was reduced to eight. Next slide.

7 And we'll take a look at some of the results. Again, these  
8 are summarized in that exposure document. We found somewhat  
9 similar results to what they found in Connecticut. And the overall  
10 concentration that we found was a bit lower. You can see that we  
11 found anywhere from 4 up to an average 79 milligrams per  
12 kilogram with overall average of 28.5 milligrams per kilogram.

13 You can see our controls. You tended to see if it was -- if  
14 you had more organic soil nearby, we tended to see slightly higher  
15 arsenic concentrations in our control. Next slide.

16 Again, a simple slide as we saw before. You see copper,  
17 chromium and arsenic. These are the average concentrations in the  
18 soil. Notice, again, that the copper and chromium background  
19 concentrations tend to be higher than we see for arsenic. We have  
20 relatively low arsenic background concentrations in Florida.

21 We did not, however, see exactly what was seen in

1 Connecticut with reference to the chromium being a lot less than  
2 arsenic. And one of the things -- and we're still kind of looking at  
3 this -- is that with the greater mobility of arsenic, what we're  
4 imagining is a lot more of the arsenic is mated down to the soil and  
5 past the zone we're able to collect because it probably tends to be  
6 the mobile of the contaminants. Next slide.

7 And to give you some idea of variability, I just picked one  
8 particular site. And this is not meant to be a histogram. It's just  
9 the actual sample numbers.

10 The first set, the first eight, being in the control, and the  
11 second eight, being the concentrations underneath the structure,  
12 just to give you some idea. There's a fair degree of spread in terms  
13 of the data, and we'll talk in a moment a little bit more about why  
14 it tends to be variable.

15 And, you know, you go and you sample underneath this deck.  
16 I mean, there was one particular site where I have the average of  
17 around 80. There was one sample that was over 200. It was 220  
18 milligrams per kilogram. So you do tend to find some hot spots  
19 here and there. Next slide.

20 To just take a quick look at some of the cores. This is the  
21 arsenic concentration. You can see concentration on the top X

1 axis. And then going down, we're talking about depth into the  
2 soil.

3 Go to the next slide, and we'll go ahead and enter the  
4 chromium data. Then one more slide, you can see the copper.

5 Now, I will say that, in terms of our trends, we went through  
6 and actually have computed the total mass to kind of integrate the  
7 area underneath that curve to see how much total mass of arsenic  
8 or copper or chromium were in these soil samples. What you found  
9 in some cases, you know, you found more arsenic; in other cases,  
10 you found more chromium.

11 It kind of illustrates the point that there's a lot of things  
12 going on, that certain soils are going to bind it more, the age  
13 matters, and the hydrologic conditions matter. Next slide.

14 So if you go to page 38 in your exposure document, instead  
15 of reproducing the table, I just thought I'd put it in quick graphical  
16 form for you.

17 But you can see five studies that were referenced, the  
18 Riedel, the Osmose study, these two studies by Doyle and his  
19 colleague, and then Connecticut and then Florida.

20 And the red bar represents arsenic, and the green bar  
21 represents chromium. I would say that really the three data sets

1 that compared the most in terms of the methodology would be  
2 Connecticut study, the Florida study, and the Osmose study. The  
3 Osmose study was just finished up fairly recently. It had an  
4 average of around 23 or 24 milligram per kilogram.

5 If you go to the next slide, I went ahead and just put the max  
6 values that were in there just, again, to give you some idea that  
7 you do see a fair degree of variability in the soil underneath a  
8 given structure. Next slide.

9 So what should be expected? Because one of the things that  
10 I've kind of come to the point is that, number one, we shouldn't be  
11 surprised that we see these elevated concentrations. And, really,  
12 you should all be able to have some kind of gut instinct about what  
13 range you might see under a deck based on some of the data that  
14 we've looked at before.

15 So if you go to the next slide, what you have here is simply  
16 assume that you have a deck. It has a known mass of arsenic. And  
17 I based this on it had 2,000 milligrams per kilogram of arsenic in  
18 the wood, which is kind of somewhere between .25 and .4, to  
19 represent the different types of woods in there.

20 Leaching graphs we showed at beginning of the presentation  
21 to give you some idea of the magnitude of how much you might

1 expect to leach over time. And then the Y axis is the arsenic  
2 concentration in the soil. And then those lines represent, if all the  
3 arsenic, for example, was bound up in the upper 2 inches versus  
4 the upper 4 inches versus the upper 8 or 12, that would be the  
5 concentration. Not that you would ever expect everything to only  
6 go to a certain level and stop but to give us some kind of sense of  
7 what we really expect.

8       So if you go to the next slide, just a quick example. Just  
9 assume that we have 15-percent leaching. Now we showed data on  
10 some of these depletion studies that are up to 40, 50 percent.  
11 Those are pretty aggressive conditions. We saw some of the lab  
12 studies that showed up towards 18 percent and some of those are  
13 somewhat aggressive.

14       But if you start -- those are short durations. If you start  
15 talking 5, 10, 15 years, I think it's fair to say that you could see  
16 10-, 20-, maybe 30-percent leaching of the material, especially of  
17 the arsenic from wood.

18       So anyway, if you assume that the 15 percent or so that  
19 leaches goes into the upper 8 inches, that would be 23 milligrams  
20 per kilogram; if you assume 4 inches, 15 milligram per kilogram.

21       So the point is that you're going to see different

1 concentrations. On the study that, you know, will follow this,  
2 when people go out and sample, you're going to see variable  
3 concentrations. It's going to depend on the soil type; it's going to  
4 depend on the type of wood; it's going to depend on the rain and  
5 frequency. Go to the next slide, please. I think I have some of  
6 these listed.

7       Yeah, condition and the age of the wood. We've already seen  
8 what dramatic difference it has. And, again, just based on our  
9 experience, it's kind of frustrating when you try and get good  
10 statistically tight data that you can go to the same piece of lumber  
11 and have very different retention values even in that piece of  
12 lumber.

13       Soil properties. If were you to have a clay soil versus a  
14 sandy soil or organic soil. The use patterns. Are you going to  
15 have little kids running on top of this and kind of grinding up little  
16 bits of wood over time? Is it something that is going to be actively  
17 used, a lot of traffic, would that have an impact?

18       Where you take the sample, you have what's known as "drip  
19 lines" underneath these decks. If you can imagine these play  
20 structures, if you have two pieces of wood and you have a space in  
21 between, the water is going to fall down that space in between and

1     you'll tend to get a lot more water on that soil directly underneath  
2     than you will the adjacent soil.

3             So if you happen to sample right there or if you were to  
4     target your sample to go right there, you would have a higher  
5     concentration than if you went in between those drip lines.

6             If you go right next to a post and sample that material right  
7     there, you're going to get higher concentrations.

8             Rainfall amount and intensity. Well, we already said -- I  
9     mean, you can imagine if you had a very slow kind of misty rain  
10    where the water is sitting on the wood a lot longer and given more  
11    time to come into solution, the concentration of the liquid that  
12    might come off might be higher. Where if you had a very short,  
13    intense rainfall followed by the sun an hour later, you might not  
14    have a great deal of time for that water to become exposed.

15            And in some of these structures, if you have a sloped area  
16    underneath that, you're going to tend to get a lot runoff; and it  
17    won't necessarily percolate into that soil underneath so that soil  
18    hydraulic conductivity or permeability.

19            So, again, I just wanted to leave the point with you that this  
20    range of values you see, I think, are going to be pretty typical of  
21    what you're going to see when you go out and repeat the study.

1 And it's going to be variable from site to site.

2 But kind of using what we know about how much we'd expect  
3 to leach and some of these previous measurements, we can, I think,  
4 develop some sense of comfort on where that data would be  
5 expected to fall.

6 Next slide. One comment, another question is, do the metals  
7 spread laterally out? In other words, this is even more important  
8 than just talking about playscapes. Because you'll have some  
9 footbridge areas and walk areas, but you're also going to have  
10 some posts. And to illustrate this, I went ahead and took a recent  
11 study that Dr. Stillwell did where he looked at the sound barriers  
12 that he referred to earlier. Next slide.

13 And what you see in this particular graph, this is arsenic  
14 concentrations. These are arsenic concentrations -- well, arsenic,  
15 copper, and chromium. And you see concentration on the Y axis.  
16 The yellow represents right underneath. Green is 80 centimeters  
17 away. And the red is a control much further away.

18 So right underneath it, you get high concentrations. Once  
19 you move away from the structure, you simply don't see that much.  
20 So I think that's something that's fairly intuitive to all of us.  
21 Where you get the contamination is where the water goes to. And

1 if you have some mechanism for the water to run off and then go  
2 down, you can have it there; but it's not really going to travel.

3 Unless we were talking about something that was in the  
4 groundwater table, it's not going to travel laterally. It's going to  
5 really stay isolated to where it is and then downward. You can  
6 have significant contamination going down. And then the question  
7 of whether it gets down deeper into the soil and gets into the  
8 groundwater or something, it still, you know, remains an issue.

9 With some of the sites we saw where the arsenic was a lot  
10 lower than would be expected, you know, one potential hypothesis  
11 is that arsenic, again, was getting beneath that upper eight inches  
12 or so that we were able to measure and going further down. Next  
13 slide.

14 I did want to make a comment on speciation. And real  
15 quickly, I -- and this is, Mr. Chairman, this is on the CD that has  
16 my presentation.

17 I went back to my room during lunch and found a recent  
18 review paper in a journal called "Environmental Pollution." And  
19 it was a review on -- it's called "Leaching of Chromated Copper  
20 Arsenic Wood Preservatives." It's a pretty good literature review.  
21 It's a PDF file. So if anybody wanted put it on their computer and

1 take a look over it the next day or so.

2 But I wanted to look at that issue about the chromium  
3 because we've been talking about fixation. And what's happening  
4 in fixation that we've been talking about is chrom V going to  
5 chrom III in this reduction reaction. But what was brought up  
6 earlier is what is the coupled oxidation reaction that's occurring  
7 with that. And, apparently, the arsenic stays in the V state  
8 according to this literature. And then the copper stays in the II  
9 state.

10 But what they cited in this paper was that it was the  
11 oxidation of hydroxyl groups on cellulose. So the actual material  
12 being oxidized was the wood itself. That was the kind of current  
13 state of thinking in terms of what the reaction was that was  
14 happening inside the wood. That was the best I was able to find on  
15 short notice.

16 But if you take a look at kind of the fixed process -- and by  
17 the way, in terms of fixation, the quote in the paper was that  
18 "fixation of wood at 15 degrees C takes 14 days." That's what's in  
19 this paper if you want to look at this later and they have the  
20 reference for that.

21 If you see these particular elements that are formed, they

1 talk about different chromium and arsenic species, some with  
2 copper. And then they talk about a number of complexes between  
3 chromium V in wood and chromium III in wood and copper in  
4 wood.

5 Now, we've done a little bit of speciation in our laboratory.  
6 It's really kind of an ongoing project that our research is involved  
7 in. Next slide.

8 I wanted to share it with you. When we've taken treated  
9 wood, most of it being new -- we're still working -- but a few  
10 weathered samples. And you do what's known as an alkaline  
11 digestion, which is how you get chrom VI out of soils. You can't  
12 do a standard digestion, acid digestion, on soils because you will  
13 turn all the chrom VI to chrom III. So you have to do a special  
14 alkaline digestion, which is an EPA method.

15 We found from about a half a percent to 5 percent chrom VI.  
16 Which, again, if you look at the previous slide and those lists of  
17 chemicals, a number of those were chrom VI. Even though it's  
18 fixed, there are a few chrom VI species. And if you actually take  
19 the wood and digest that -- well, at least we've been able to in the  
20 lab find it.

21 However, when we do a leaching test, that's not what leaches

1 off so we're not finding any chrom VI in the leachate. Or if it did  
2 leach off, it got converted to chromium III during the leaching  
3 process.

4 Now, one thing that's relatively new that I'm not prepared to  
5 say a lot about. You would expect most of the chromium in the  
6 soils underneath the structure to probably be chromium III because  
7 of organic matter and reduction in the environment.

8 But what we have detected -- you know, we're still having to  
9 go back and do this -- is some chromium VI in the soils. We're  
10 talking maybe 5 milligram per kilogram or something like that. So  
11 it's not a tremendous amount. But the fact it was present was a  
12 little bit surprising.

13 There's literature out there that shows that you can get  
14 oxidation when you have different manganese materials. And  
15 there's even some studies where you have iron in it and light that  
16 can cause some oxidation.

17 I'm not sure that was the reason for any of these things or  
18 not, but it certainly points to the need in this future study that EPA  
19 will do to kind of look at that because it has a potential.

20 Again, chrom VI, by and large, is not going to be a major  
21 component of these materials that we're talking about. But it

1 certainly is present in some small amount in the wood. And I think  
2 we saw a little about of that yesterday in the presentation, you  
3 know, small amounts on the wood film. And then we found a little  
4 bit in the soil. Next slide.

5 Now as far as arsenic goes, the speciation that's been done  
6 today which has been using HPLC, hydride generation, and then  
7 atomic fluorescence spectrometry has only found inorganic species  
8 of arsenic. And they looked for MMAA and DMAA in those.

9 And new wood samples, everything that we found in SPLP  
10 leachate showed an arsenic valance of 5. And if you go and start  
11 looking at the older samples, you did begin to see III form.

12 Now, how much? It's going to take some additional work on  
13 that, but there were the two inorganic species in the older woods  
14 samples.

15 All the leaching tests that we've done on soils, we haven't  
16 really figured out a digestion extraction for the soils themselves.  
17 But a leaching test on the soils, everything we found has been an  
18 arsenic V. And it's all been inorganic, at least any of those two  
19 species that have been present.

20 And, again, it is somewhat preliminary; and, you know, it's  
21 not something that has been peer-reviewed or published. But I

1     though at least in terms of your discussions it might be worthwhile  
2     for you to at least know some of the work that's going on. Next  
3     slide, please.

4         Okay. Well, that's the end of this particular presentation.

5         DR. ROBERTS: Let's go ahead and take some questions,  
6     then we'll probably take a break before we get into your buffering  
7     materials.

8         We have a number of people who have raised their hands.  
9     But before we start with the first question, let me go ahead and  
10    make the request if you could get us the PDF for that paper, we'll  
11    get it printed out, distributed to the Panel, and added to the  
12    document.

13        DR. TOWNSEND: It's on the CD now.

14        DR. ROBERTS: Dr. Styblo, then Dr. Mushak.

15        DR. STYBLO: A very nice presentation. Obvious question  
16    about speciation. What kind of method do you use for speciation  
17    of chromium? And can you give us more insight about the  
18    speciation method used for arsenic.

19        DR. TOWNSEND: Yeah, I'll do the best I can. For  
20    chromium, we use ion chromatography. If it's a soil sample, we  
21    would do the alkaline digestion. When we do the ion

1 chromatography with a Dionics column to separate the chromium  
2 species. And then there's the carbazide color metric reaction  
3 which we have a spectrophotometer to look at.

4 And it's not something too complicated. Heat generates the  
5 calibration curve and runs the samples. We do that immediately  
6 afterwards. So when we produce a leachate, it's done within a few  
7 hours. Where if it produces that digestion procedure, it's done  
8 right away.

9 Let's see for the arsenic speciation, again, I'll give my little  
10 spot on it and then Helena can add in if there's more detail needed.

11 But again, it's AHPLC to terms of separation then it's a  
12 hydriatric generation phase. And then as a detector, use atomic  
13 fluoresce.

14 DR. STYBLO: When you say "AHPLC," how do you prepare  
15 a sample for each species? Does it include it in digestion that  
16 could possibly destroy --

17 DR. TOWNSEND: I believe they've all been done in aqueous  
18 samples; they've be filtered. But those aqueous samples are put on  
19 directly.

20 DR. SOLO-GABRIELE: Yes.

21 DR. STYBLO: So when you talk about the organic arsenic in

1 wood, you're talking about whatever is extracted from wood by  
2 water.

3 DR. TOWNSEND: Yeah. Whatever is in the species. We  
4 didn't actually do an extraction of the wood. Unlike the  
5 chromium, where we have this alkaline digestion procedure, we are  
6 not familiar with a extraction procedure. So all the data that I  
7 reported were on aqueous samples; they were either leachates. But  
8 they were not necessarily representative of what is totally in the  
9 arsenic.

10 DR. STYBLO: How about soil samples?

11 DR. TOWNSEND: Soils were also done on SPLP leachates,  
12 so they were only what leached in an aqueous solution.

13 DR. STYBLO: Thank you.

14 DR. ROBERTS: Dr. Mushak.

15 DR. MUSHAK: Paul Mushak. Excellent presentation, by the  
16 way.

17 DR. TOWNSEND: Thank you.

18 DR. MUSHAK: The rainwater leach tests indicate that you  
19 have continued leaching of arsenic. And if you combine that with  
20 this long-held view of chromium fixation but with some ambiguity  
21 about the copper and arsenic binding, this suggests that fixation of

1 chromium occurs but you have ligand equilibria with arsenic and  
2 copper.

3 And if we go back to freshman chemistry principles, this  
4 says, by way of the Le Chatelier (ph) principle, that as you shift  
5 equilibria in ligand and exchange the equilibria, the system  
6 responds to relieve the stress. So as you're pulling arsenic out as  
7 shown in your leach test, you're getting kind of this bop-along  
8 arsenic among ligands.

9 DR. TOWNSEND: Right.

10 DR. MUSHAK: So I think the notion of fixation has to be,  
11 you know, held in a qualified way with arsenic or even copper for  
12 that matter. I think chromium fixes the way it's described, but I'm  
13 not sure that the ligand binding is as simple as people say.

14 Could you comment?

15 DR. TOWNSEND: Well, I think, you know, what you said  
16 all makes real good sense. I would just encourage everybody, you  
17 know, if you want to read a little bit more about fixation to again  
18 go to that paper which was that recent review. And they go into  
19 similar discussions. And they talk about the issues of fixation.  
20 And, again, keeping the arsenic in has always been the difficult  
21 part.

1 DR. ROBERTS: Dr. McDonald.

2 DR. MCDONALD: Peter McDonald. I'll just restrict my  
3 comments to the Florida and Connecticut studies. First of all,  
4 were there many below-detection-limits readings especially in the  
5 control groups in those studies?

6 DR. TOWNSEND: In the Florida samples, what we did is we  
7 went ahead. We could do a lot of things on something like the  
8 ICP. But once we got to controls, we went ahead and went down  
9 using the furnace. So we lowered our detection limit to be able to  
10 measure something. So there weren't a lot, but they were pretty  
11 low concentrations. We were getting down to about -- on the  
12 furnace, we'd get down to .4 milligram per kilogram, something  
13 like that.

14 DR. MCDONALD: Also, you listed the sources of variation.  
15 And, presumably, you have that information about each sampling  
16 site. So I would expect you would be able to put those in as  
17 covariants and be able to reduce the amount of unexplained  
18 variation in the final fitted model. Is that possible?

19 DR. TOWNSEND: Yeah. We've explored that a little bit.  
20 It's on one sense we can go and identify a high sample, for  
21 example, and get an idea that it was perhaps near a drip line or

1 something like that. But when we started putting things like age  
2 in, even if you start off as something as simple as age, it's been  
3 difficult to find any specific pattern.

4 But I mean I will say that we have not taken it perhaps that  
5 step that you talk about and try to do a multivariant analysis like  
6 that or anything.

7 In Connecticut, what Dr. Stillwell was able to find is a little  
8 bit better in terms of as a function of age. You saw the total  
9 concentrations increase except for the oldest sample which  
10 happened to be to one that was sealed as well.

11 So we've -- you know, we've tried to go through and look at  
12 it in a number of different ways to begin to explain it a little bit  
13 more. But it's been a challenge.

14 DR. MCDONALD: The EPA is proposing a study much like  
15 this, so it would be interesting if these things could be built into  
16 it.

17 DR. TOWNSEND: Yeah, that's good. I agree.

18 DR. ROBERTS: Dr. Smith.

19 DR. SMITH: Andy Smith, Maine Bureau of Health. And I  
20 want to follow with my other colleagues in commending you for a  
21 very nice presentation.

1           Three brief questions. One is can you talk to me so I  
2           understand your leaching method. You've got a leachate. I assume  
3           there's a filtration step before you do the sort of analysis or it goes  
4           into the instrument; is that correct?

5           DR. TOWNSEND: There's a filtration step; correct.

6           DR. SMITH: And what's the pore size of the filtrate?

7           DR. TOWNSEND: It's a .7 micron. It's what's prescribed in  
8           the TCLP test. That's my recollection.

9           DR. SMITH: Okay. The next question is for your fieldwork  
10          in looking at the various soil samples collected beneath the  
11          structures, were you able to get any information on to what extent  
12          these structures may or may not have been treated with any sealant  
13          post-CCA treatment.

14          DR. TOWNSEND: I don't believe that we gathered any  
15          information that was specific to saying that they were sealed or  
16          not. I think for general things, for the most part, they weren't. I  
17          don't know if Helena --

18          DR. SOLO-GABRIELE: Visibly, you couldn't tell.

19          DR. SMITH: You couldn't tell. So we don't know to what  
20          extent that accounted for variability --

21          DR. TOWNSEND: That's correct.

1 DR. SMITH: -- in the data as well.

2 DR. TOWNSEND: That's correct.

3 DR. SMITH: Last question is I'm very curious about the  
4 comments you made on a couple of instances about the variation in  
5 the arsenic content of the wood itself as a result of both treatment,  
6 et cetera. And I believe you even mentioned within a board.

7 Can you just talk to me a little bit more about that? Have  
8 you actually made measurements where you have done cores into  
9 boards, et cetera, to give -- because you know, again, we're trying  
10 to understand all this variability we're seeing.

11 DR. TOWNSEND: Sure, sure.

12 DR. SMITH: So any information you could provide --

13 DR. TOWNSEND: Yeah, yeah. I would say that most of that  
14 comment I made was based on just kind of anecdotal experience in  
15 the laboratory. But we, for example, you know -- and we do have  
16 some data that we could share where we would take a given sample  
17 and we would have it run on XRF at one particular treating  
18 facility, run an XRF at another particular treatment facility, and  
19 then run maybe we even try and do something like a total  
20 digestion, which is tough because you're only taking, you know, a  
21 few grams with such a large, you know -- you have to get a very

1       homogenous sample to do that.

2               And then with all three of those different measurements or  
3       even just going back and, you know, repeating that on the same  
4       particular instrument from a different area on the board, you  
5       would find, you know, again, plus or minus 30 percent.

6               So I guess there's some information. But a lot of that might  
7       be method-to-method variabilities as well. So I don't know that I  
8       can offer a real good set of data for you to look at to maybe give  
9       you more comfort on that. I'm primarily sharing that as just some  
10      anecdotal experience in terms of working in the lab.

11              And hearing, going to talks made by wood preservation  
12      scientists who encounter the same thing when they do their  
13      research.

14              DR. SMITH: Okay. Thank you.

15              DR. TOWNSEND: You're welcome.

16              DR. ROBERTS: Okay. If there are no other questions, thank  
17      you very much, Dr. Townsend. I guess you'll be up right after the  
18      break to talk about buffering materials.

19              Let's take a 15-minute break and then reconvene.

20              (Brief break.)

21              DR. ROBERTS: Are we ready to go? Let me just announce

1 at the outset that it is my intention, if it's humanly possible, for us  
2 to get through the first two questions before we break today. We  
3 still have a couple of presentations to go, but I don't know that it's  
4 going to be too much longer' and then we'll be able to get into  
5 some of the discussion of some of the questions.

6 Dr. Townsend, can you, I guess, resume with your  
7 presentation on buffering materials.

8 DR. TOWNSEND: This presentation was a little bit difficult  
9 to come up with. EPA had recently kind of started to address this  
10 issue of buffering materials. And I'll talk about what that is in a  
11 moment. But it's something that kind -- the reason I'm presenting  
12 is it has some relationship to some of this construction demolition  
13 debris ending up as a buffering material. So I'll go through that  
14 issue in a moment.

15 Also, I'll show you a few slides that relate to some other  
16 issues that have been raised by different members of the Panel.  
17 First slide, please.

18 If you look at the National Safety Council Fact Sheet of  
19 Playground Safety, one of their -- in fact, it's the number one list  
20 of their recommendations that surfaces around playground  
21 equipment should be filled with at least 12 inches of loose fill such

1 as wood chips, mulch, sand, or pea gravel. And so we've talked  
2 about that already today.

3 But this is what we're referring to when we're talking about a  
4 buffering material, something that would make a fall less  
5 hazardous or less injurious to someone who happened to have an  
6 accident on a playground. Next slide.

7 Here you see -- I believe these are some different  
8 playgrounds up in North Florida. This is CCA-treated wood. But  
9 here is sand which is used at this particular side. Next slide.

10 This is another example, CCA-treated wood playground,  
11 sand. Next slide.

12 This one, I believe, this is pea gravel. I didn't take this  
13 picture, so it's either pea gravel or mulch. But, again, you can see  
14 that this is one of those elaborate kind of castles that they build  
15 for children, and a large, large amount of pressure-treated wood  
16 used to construct these things in many different shapes and sizes.  
17 Next slide.

18 And this is the tire material. Tires are a big problem in  
19 terms of solid waste management. And one of the primary ways to  
20 recycle them is to grind them up, take out the metal, and have the  
21 rubber kind of in little pellet-sized forms.

1           And there's a number of manufactures who sell products.  
2           The one in Florida is called "Rebound" or "playscape." It's a  
3           material that they go out and they put down. And trust me, you can  
4           fall on it, and it will absorb some shock.

5           This is actually the playground where we live. And if you  
6           notice that red fence, I'll tell you about what that means in a  
7           moment. Next slide.

8           The objectives today were really to kind of just bring up this  
9           issue of buffering materials and then the contamination from  
10          CCA-treated wood in playgrounds. And it's an issue where there is  
11          really not much literature to go to and present any information on  
12          it. It's kind of something that only recently we learned that we  
13          may or may not need to look at. So I'm going to try and give, at  
14          least, a good overview of what we know and maybe throw out some  
15          issues for discussion. Next slide.

16          Really, two separate issues. One of them is the  
17          contamination of buffer materials from playground wood leaching.  
18          In other words, you have the play structure and it leaches as we  
19          talked about in the last presentation. This leachate, instead of  
20          contacting the soil and contaminating the soil, what happens when  
21          that same leachate drips on top of mulch or drips on top of pea

1 gravel or drips on top of tire chips. So that's one issue.

2 The second issue is one that I can share a little bit of insight  
3 in. And that is the idea about whether or not the mulch itself, the  
4 buffer material itself, containing CCA-treated wood. So I'm going  
5 to show you some slides on what we've encountered in Florida, and  
6 why it could be potentially an issue. So next slide.

7 What we've been doing in Florida is looking at, of course,  
8 CCA-treated wood as a whole; and then, of course, we started with  
9 respect to disposal issues. As it turns out, one of the recycling  
10 methods for construction demolition debris wood which may  
11 contain CCA is mulch.

12 Now, I will say that the extent to which this mulch is used in  
13 playgrounds, we don't have any numbers on. We know that this  
14 mulch is being produced, and we know that mulch is used in  
15 playgrounds. And there was, you know, there was one report.

16 In fact, I think it was someone who gave Helena a call. And  
17 this was out west somewhere where she went out and had a bunch  
18 of new mulch put down in her playground and found one of the end  
19 tags off a CCA piece of lumber. You know, she could read the .25  
20 on there. So it is something that's been experienced in other parts  
21 of the U.S. So next slide.

1       Here's wood from construction demolition debris. It's all  
2       different shapes and sizes. You might notice some CCA-treated  
3       wood in there if you've got good eyes and can distinguish some of  
4       that color, that green wood. Next slide.

5       There's a big push in Florida to recycle this material. So it's  
6       either going to go to a landfill or all this wood which is going to  
7       be plywood, dimensional lumber, as well as some treated wood,  
8       and it goes to a big recycling facility. Not in every place, but in  
9       some places it gets recycled.

10       So you see this wood. Just kind of note that it begins to be a  
11       little bit more difficult to see the treated wood once you start  
12       mixing it in. Next slide.

13       Here's a big pile. And this is not uncommon at a number of  
14       facilities. They have large piles. And if the lights were dim, you  
15       could probably see a lot of green poles in there. And this was at a  
16       recycling facility. And what this person was doing was grinding it  
17       up and probably coloring it -- which I'll show you in a minute --  
18       and using it as mulch. Next slide.

19       Another slide of a large pile of wood that's probably 30-feet  
20       high or so, waiting to be processed and ground up. You can see a  
21       palette and maybe some fencing materials as well as even some

1 vegetative debris. Next slide.

2       These large grinders, they grind it up. Wood is big part of  
3 C&D in terms of volume. So they really want to recycle it  
4 because, you know, if they had to pay to put it in a landfill, that  
5 means a lot to their bottom line. Next slide.

6       One of the markets that has emerged -- well, the market that  
7 is traditional is to burn it as fuel. There are issues with  
8 CCA-treated wood in that as well because of arsenic volatilization  
9 and off-gasses and the ash. But using it as mulch, is something  
10 that has been proposed. You can see, it says "free mulch." This is  
11 for anybody in the local area to come pile this up.

12       And from what I recall, that pile probably has anywhere from  
13 -- I don't know -- 5- to 15-percent CCA-treated wood mixed in  
14 with it. Next slide.

15       Now, that's a pile of red much. And I don't know how many  
16 of you have noticed this red-dyed mulch. But it's like the biggest  
17 craze right now for C&D wood processors and a lot of people who  
18 process land-clearing debris. And it's an iron dye that they spray  
19 on this thing. A big manufacture, Bayer, for example, makes this  
20 chemical. They spray this on there, and they get a nice, pretty red  
21 color. Next slide.

1           And then a lot of it is bagged up. Now, I'm showing -- this is  
2           -- you can probably tell, this is at Home Depot. And there are  
3           pallet loads of this material.

4           Now, I will say that not all of it comes from construction  
5           demolition debris. There are people who take mulch from old  
6           trees, logs, land-cleaned debris, grind it up and color it. And this  
7           is an example of one of those companies. You could not find any  
8           C&D wood in there, I would imagine. But there are others who  
9           are. Next slide.

10          This is a parking lot in a restaurant we were happening to be  
11          passing by.

12          And as you can see in the next side, I made the graduate  
13          students start digging through it. And here's what we pulled out.  
14          You can see a piece of painted wood, some fiber board, some  
15          lumber, some plywood.

16          I encourage you next time you see a pile just to stop and  
17          stare because plywood -- you could usually see plywood. Plywood  
18          is not something that you would normally encounter in nature. So  
19          these different plies of these woods occurring, you can typically  
20          tell.

21          And there was a phone call to a DEP inspector. It was a

1 woman down in the Keys, bought a bag of mulch at one of these  
2 stores, brought it home, opened it up, and found pieces of  
3 electrical tape and a piece of plywood and all sorts of things in  
4 there. It's an issue.

5 And then what happened is down in South Florida where a lot  
6 of this was really starting to kind of hit the press was there were  
7 these newspapers articles coming out that says "red poisonous  
8 mulch." And of course, the mulch dyers got all upset because it's  
9 really not the red that's causing the poison, it's what I'm about to  
10 show you in a moment which is the presence of CCA. Next slide.

11 I wanted to thank Dr. Wargo and some others yesterday, Dr.  
12 Mushak, were asking about disposal issues. And so I hope you  
13 bear with me for just maybe one minute while I show you a couple  
14 of slides.

15 But most of the wood is either going to go to a C&D landfill,  
16 construction demolition debris landfill, which is unlined in  
17 Florida. Or it's going to go to a C&D or construction demolition  
18 debris processing facility where it's either going to be processed  
19 and burned as wood or it's going to be land-applied as mulch.

20 A point to make is that it's very difficult to tell when  
21 something is treated or not. For example, if you look at the

1 weathered southern yellow pine that Dr. Stillwell brought over  
2 here, if you had weathered CCA that had been sitting in the sun  
3 that was southern yellow pine, you'd have a hard time telling the  
4 difference because it all turns gray after a while. And so these  
5 C&D processors are faced with the issue of trying to separate  
6 them. Next slide.

7 Just to show you some information on -- projections that our  
8 research team has done. We're talking -- because of the fact that  
9 CCA hasn't been used heavily for that long, it's only been the last  
10 few decades, most of it hasn't entered the waste stream.

11 In other words, most of the wood in Florida that's ever been  
12 treated and purchased is still sitting out there as a deck or a fence  
13 or a pole. But those are eventually going to have to be disposed.  
14 And, of course, they'll enter solid waste stream.

15 So we're only kind of looking at the very forefront of this  
16 wave of material that should be entering the solid waste stream.

17 And if you look at production statistics, you would expect  
18 by, you know, 2015, 2020, or so, that current use is about 30  
19 million cubic feet of CCA-treated wood that are going to enter  
20 the waste stream. And that pink line that you see is simply stating  
21 the fact that if somebody banned CCA-treated wood and totally

1       went to another type of treated wood, we still have this out there  
2       and it's still going to be entering these landfills and recycling  
3       facilities for a long time to come.

4           And then the next slide will put it a little bit more in  
5       perspective. But if you look at the cumulative kind of arsenic  
6       balance in Florida, we're importing about 1,600 tons of arsenic  
7       into the state every year in the treated wood. And kind of the  
8       bottom line to this slide is that, you know, 1,600 tons been  
9       disposed. There's a certain amount that's going to be lost in terms  
10      of leaching and such. But most of it is still sitting out there.

11          And so one of the issues that we're wrestling with is: How  
12      do we get it and do something with it before it ends up getting  
13      managed in an improper place?

14          So I just wanted, you know, since there were some questions  
15      asked about that -- I thought I'd share some of that information  
16      with you. Now next slide.

17          Back to the mulch. What we did is we went around to C&D  
18      processing facilities and sampled their chipped wood. Some of it  
19      was destined for mulch. Some of it was destined for fuel. And we  
20      found that on average, about 6 percent of the chipped up wood at  
21      these facilities was CCA-treated. That was based on going around

1 the state, collecting a large, big, trash-can size amounts of sample  
2 and doing analysis on that.

3 As Dr. Solo-Gabriel referred to earlier, more recent studies  
4 that we've done have shown 10 to 30 percent in a typical pile of  
5 wood from construction demolition debris containing CCA-treated  
6 wood. Next slide.

7 I wanted to also show that we did some follow-up testing  
8 just recently, taking the mulch and doing that leaching test.  
9 There's one issue that you're going to run into with buffers is, you  
10 know, those of you who are used to doing lab work, when you do a  
11 standard metals digestion you take -- what? -- between one and 2  
12 grams to do a hotplate digestion. Or if you're doing a microwave  
13 digestion, you may be doing .4 grams. That's not a lot of material.

14 When your sample is a bunch of wood mulch or tire chips or  
15 pea gravel, how are you going to -- I mean, are you going to just  
16 take one little piece? Because one piece might be more than that.  
17 Are you going to grind up the whole material? That's an issue that  
18 I think needs to be discussed.

19 But one real easy way to determine whether arsenic's there  
20 or not is to do -- or CCA-treated wood -- is to do a leaching test.  
21 Because as we saw earlier, arsenic leaches fairly readily from the

1 wood so it's a real good indicator. So we did SPLP on all the  
2 mulch samples.

3 And if you look at the results on this next slide, it's a  
4 histogram of arsenic concentration in microgram per liter  
5 observations. So you can see that -- and, of course, what we do in  
6 Florida -- as kind of a solid waste person, you know, I don't get in  
7 and do the risk assessment. I simply do the leaching test and  
8 compare it to a groundwater cleanup target level or a primary  
9 drinking water standard or something like that.

10 And you can see that by and large almost all of them exceed  
11 the 50-part per billion arsenic drinking water standard or  
12 groundwater cleanup target level in Florida.

13 Those that were below that were atypically ones that was all  
14 processes yard debris. This not only includes those original  
15 samples that we did in that first year but also some samples where  
16 we went out to the store and bought material.

17 And as Helena was talking about earlier, we've had people  
18 send in mulch samples that we'll do some tests on them and you  
19 can pretty much tell. If you pick it out and you can find a piece of  
20 plywood in it and you run SPLP on it, you'll have arsenic that will  
21 be 50, 100, 200 parts per billion. Next slide.

1 Well, kind of in summary -- and we'll get back to that --  
2 there is this mulch. Now, I have to say again: Are those reaching  
3 the playgrounds? No. Does the industry, the tree-wood industry,  
4 say that people should be chipping up mulch? No, absolutely not.

5 You know, Scott said this morning, that's not their -- you  
6 know, they don't go out and manufacture treated wood mulch at  
7 least as far as anyone has ever told me. It's simply incidentally  
8 ending up in there, but it's ending up in there.

9 And so that was the issue that EPA wanted to raise as  
10 whether or not that's something to look at. In theory, if there is a  
11 certain type of mulch in that playground and a child picks up a  
12 piece of wood and puts it in their mouth, not only could that be  
13 something that has 50 parts per million, or milligrams per  
14 kilogram arsenic, it could be 2,000 or 3,000 milligrams per  
15 kilogram arsenic. Something that they're putting in their mouth if  
16 that material happens to be there.

17 Now, the second issue was whether or not just regular buffer  
18 materials, how do they compare the soil in terms of are they going  
19 to retain these metals? Are kids going -- you know, can they be  
20 contaminated? If a child is picking that material up, are they  
21 going to get exposure as a function of that?

1           And I don't think you're going to find really much  
2           information at all out there. So I wanted to share a few things with  
3           you. If you go to the next slide, please.

4           This is Alachua County which is where University of Florida  
5           is located kind of in north central Florida. The county  
6           environmental protection department went out and sampled all  
7           their playgrounds. And a lot of them had mulch because, as we  
8           talked earlier, the municipal facilities, you know, the city and the  
9           county facilities typically have a buffer material. There's tire  
10          mulch right there.

11          And now if you look, that primary CCA structure is not  
12          CCA-treated. It's metal and plastic. But they had a border all  
13          around that was made of CCA. And you can see some fence  
14          material in the background.

15          What they did is they went to about five different parks in  
16          Alachua County. They sampled both soil that was adjacent to any  
17          CCA wood as well as these buffer materials, this mulch or tire  
18          chips. Most of it was tire chips. There was one site that was wood  
19          mulch that was adjacent to it. And then they went back and did  
20          analysis on it.

21          And to be perfectly honest, I don't know that they went and

1 ground up these samples and did a total digestion on them or not. I  
2 was not able to get that information. This is a very, a relatively  
3 new study.

4 So if you go to the next slide, it's a little bit busy; but I  
5 wanted just to show you the results. Let me walk you through what  
6 this table is. Five sites, A through E. The top border post area,  
7 border refers to one of these woods borders as we saw on that last  
8 slide where they used these large eight by eights or something to  
9 kind of hold the soil back and separate the mulch from the rest of  
10 it.

11 The post means that there was some type of post,  
12 treated-wood post, in the playground and they sampled the  
13 material next right next to that. And then the area would be some  
14 area away from the treated wood. So in the middle, either in the  
15 soil, outside of it, or in the mulch there in the middle.

16 And if you look at the concentration, M is mulch and S is  
17 soil. You can see typical ranges which I presented already in the  
18 presentation before the break.

19 And I did, just as an example, point out that when that Site D  
20 right there, where I've highlighted the mulch, that was from that  
21 picture I showed you earlier. Those were those tire chips right

1 next the CCA-treated border. Then you can see the two  
2 measurements that they collected and had analyzed by an outside  
3 lab, 48 and 70 milligram per kilogram. Anyway, that kind of gives  
4 you some idea.

5 Now, if you look at the area when it's away from the  
6 structures, it kind of goes to what we talked about before. It's not  
7 really laterally distributed. It does -- you know, it pretty much  
8 stays where the -- wherever the leachate produced from the wood,  
9 wherever it's going to go, that's where it's going to go. Next slide.

10 And then I just, you know, I wanted to be able to contribute  
11 something a little bit more in terms of this issue about buffer  
12 materials. So I had a graduate student last week just run a real  
13 quick lab experiment just to maybe to stimulate a little discussion.

14 We created some leachate by leaching CCA-treated wood.  
15 Okay. We created leachate, filtered it. So we had leachate. And it  
16 had about 8 milligram per liter arsenic in it, which is what we have  
17 seen in our SPLP leachates.

18 And then we did some tests where we took 100 grams of  
19 different buffer materials, soil, as well as -- we had three types of  
20 soil, a clay, an organic soil and a sandy soil. Then we took some  
21 tire chips. Then we took some cypress mulch and we took some

1 pine bark. And we did separate experiments and did them in  
2 triplicate.

3 And here you can see -- and what we did then is we measured  
4 the concentration in the leachate. So we didn't have time to go do  
5 a complete mass balance, but we wanted to see how much was  
6 absorbed by the particular materials.

7 So the results are on the next slide. And if you look, the Y  
8 axis right here is the percent retained. So this is how much. The  
9 higher the bar, the more arsenic was taken out of solution. Okay.

10 And, if we go through these, the clay took almost all the  
11 arsenic out. That's not a surprising thing. We know that clays,  
12 their surface chemistry, their small particle sizes, absorb metals  
13 very well.

14 If you look at the others, the sand, the kind of organic sand,  
15 pine bark, cypress mulch, and tire chips, well, the thing that struck  
16 me was, number one, is that tire chips and the pine bark were  
17 comparable to at least sandy soil.

18 In other words, they pulled it out. But the thing, if you take  
19 that a step further, they have such -- they have smaller surface  
20 areas since they're larger particle sizes that the fact that they can  
21 pull out an equivalent amount means that there is, obviously, some

1 problem surface chemistry going on where they will stick to these  
2 surfaces. They won't stick to it as much as a clay soil.

3 This combined with those results from the Alachua County  
4 work show that if you do have leachate, at least to me, I think it  
5 gives good evidence that if you do have leachate coming from the  
6 wood and it travels through this material, that some of it is going  
7 to absorb to this material. And it's going to, in this some fashion,  
8 it's going to be like -- it's going to be like soil. Not necessarily  
9 take up the same amount, but it will certainly take up some of that.

10 I think this is the final slide.

11 But then the thing that I raise is how do you sample and how  
12 do you analyze that? Because, again, when we're used to doing  
13 samples in the lab and we're talking about soils or ashes or other  
14 things that we do, you have small particle sizes so you can mix and  
15 you can take two grams out and do a hotplate digestion on it. And  
16 you can be fairly confident that you're going to get a fairly  
17 representative sample.

18 However, a tire chip might be 2 grams or a wood chip might  
19 be 10 grams, you know, depending on the size. So that's going to  
20 be an issue. And then if you grind it up, well, does that tell you  
21 what you want the know? I mean, you can get an overall

1 concentration, but you're talking about things where you have  
2 much larger surface area.

3 So those, I guess, those are issues. And then exposure, I  
4 mean, that's kind of you all's expertise. But I will share a story  
5 that I thought about this morning that that playground they just  
6 closed about a year ago, my daughter and I -- and one of her  
7 favorite games when we go to this playground with the tires is to  
8 pick up the tires and let them fall from her hand.

9 She'd get a big kick out of picking these things up and  
10 putting them down. We'd play a game where I'd put my hands out  
11 and she'd put the tires in there and we'd do it back and forth. And  
12 spent -- and one of the -- she loved to do it underneath the  
13 playground. I mean, we were sitting out of the sun, underneath,  
14 out here, scooping shredded tires into each others hands for, you  
15 know, a half-hour or something like that.

16 So when you go to these playgrounds, these mulch materials,  
17 like especially tires, the kids are playing in them, they're digging  
18 in them, you know, they're burying themselves in them. You go  
19 home, and you'll track them all over your house because they get  
20 in your shoes. They're things that aren't -- they're not -- it's not  
21 something that people, at least in my experience, that a child, will

1 try to avoid.

2 So, anyway, that last part is just some kind of personal  
3 experience maybe to share with you.

4 And I believe that's all I have in terms -- oh, I did, for those  
5 of you who aren't familiar with the Florida research, all the reports  
6 and published data is on a web site that you can easily download.

7 DR. ROBERTS: Thanks, Dr. Townsend. Are there any  
8 questions? Dr. Ginsberg.

9 DR. GINSBERG: What methodology do you think you used  
10 to see what the dislogeable residue is on a piece of buffer  
11 material? Do you think that's a feasible test?

12 DR. TOWNSEND: Yeah, I haven't put a lot of thought into  
13 that. The thing that I do when somebody wants to know whether or  
14 not there's arsenic in mulch is I do a leaching test because I know  
15 the arsenic comes off. But that's really just indicative of whether  
16 or not it's there. I haven't put any thought into exposure, how  
17 much, you know, would get onto a hand or anything like that.

18 DR. GINSBERG: But the result from Alachua -- I can't  
19 pronounce that --

20 DR. TOWNSEND: It's Alachua, yeah.

21 DR. GINSBERG: -- County, it suggests that those rubber

1       shreds near a CCA-wood source can be in the range of 50 to 70  
2       parts per million and that was total digest of the sample, I assume.

3             DR. TOWNSEND: That's what I assume as well.

4             DR. GINSBERG: Yeah. So then if you assume that that's all  
5       on the surface, then the surface concentration, if it's dislodgeable,  
6       it's going to be a fairly substantial concentration.

7             DR. TOWNSEND: I would think so.

8             DR. ROBERTS: Dr. Hopenhayn-Rich, then Dr. Smith.

9             DR. HOPENHAYN-RICH: This is just a comment based on  
10       one of the last things you said about bringing stuff in your shoes.  
11       That since we've been talking about other relative exposure or  
12       sources of exposure, I have been wondering when the discussion is  
13       about how much the surface area of the child is exposed. I have  
14       wondered what happened with the clothes that are in the  
15       playground and coming home. That's just a comment.

16            DR. ROBERTS: Okay. Dr. Smith.

17            DR. SMITH: Andy Smith, Maine Bureau of Health.

18            Can you just summarize for me, again. You've talked about  
19       data that you have from doing leachate tests, if I'm correct, on  
20       some of these materials around playground structures. So can you  
21       summarize for me, again, your sense of what there is for data for

1 other general sampling for the presence of arsenic or chromium in  
2 various sorts of buffering materials versus under existing  
3 CCA-structure playground structures. Do you have a sense for  
4 that?

5 DR. TOWNSEND: The only data set that I've seen that I  
6 think that EPA gathered was this recent Alachua County study.  
7 I'm not aware of any others.

8 DR. SMITH: And that, again, I guess that's a question to the  
9 EPA folks as well. Again, that's the only data set that you're  
10 aware of.

11 VOICE: That's correct. That's the only data set. We just  
12 received that.

13 DR. ROBERTS: Are there any other questions? Thank you  
14 very much, Dr. Townsend, for your presentation.

15 The next item on the agenda is a presentation by Dr. Bob  
16 Benson from Region 8 on exposure assumptions used in the  
17 Superfund Program. Dr. Benson.

18 DR. BENSON: Thank you. I'm Bob Benson from Region 8.  
19 I work in the Drinking Water Program.

20 I'd like to make it clear that I don't normally do exposure  
21 assessments. So I'm just going to try to talk briefly about a couple

1 of principles that Region 8 thinks are important and then talk  
2 about the dermal exposure guidance. Can I have the next slide,  
3 please.

4 So I want to talk a little bit about the ingestion of arsenic  
5 from soil, and then, as I said, dermal absorption of arsenic from  
6 soil. Can I have the next slide.

7 This is the basic equation that EPA uses to calculate the  
8 daily intake from ingestion of soil, specifically for arsenic where  
9 you've got the concentration of the soil, concentration of arsenic  
10 in the soil, how much soil is ingested per day, the bioavailability  
11 of the normalizing parameters dealing with exposure durations and  
12 body weight. The most important three parts of that are the  
13 amount of soil intake, the concentration of the arsenic in the soil,  
14 and the bioavailability.

15 Based on Region 8's experience with the variability in the  
16 percent bioavailability of arsenic from soils across a number of  
17 different superfund sites in Region 8, we got a couple of  
18 recommendations that we'd like to make in the pesticide programs.  
19 Going back -- I want to leave this slide up for a while.

20 The first one is that they need to settle on a model to  
21 measure the variability. Dr. Roberts likes monkeys. And as I, like

1 Dr. Aposhian, like hamsters.

2 I don't think there's been a study of the same soil in each of  
3 those three models to see how much variability there is across  
4 them and maybe none. Who knows.

5 But based on what Region 8 has seen across different sites,  
6 there's either a big difference in the amount of the structure of the  
7 arsenic in the soil or variability in the soil which has a very  
8 profound influence on the bioavailability so that the modeling and  
9 the type of soils that are involved needs to be sorted out.

10 Then after you make decisions on the appropriate biological  
11 model to use, we would recommend that you go out and just collect  
12 samples from parks and residential areas where CCA-treated  
13 lumber has been used and just see how much variability you get.

14 As far as I can recall from the data sets, there's probably  
15 only a few data sets on, maybe only one, actual CCA soil with CCA  
16 material in it. And we would recommend that that's probably not  
17 an appropriate way of going about figuring out what the  
18 bioavailability is of arsenic from soil across the entire country.

19 Then the last thing that I want to mention about absorption  
20 from soil is the superfund program typically, with regard to the  
21 soil intake, would make an attribution of how much is actually

1 coming from the site as opposed to a residential area and how  
2 much from intake of dust within the house.

3 And each of those probably has, you know, each of those  
4 sources would have different amounts of arsenic in them. And it  
5 would be important, particularly for a situation where a child is  
6 going out to play in a park. The superfund program would  
7 probably say it's probably not appropriate to take the total amount  
8 of soil ingested per day as coming from that particular park, that  
9 you need to make an attribution of what the various amounts of  
10 soil are consumed from the various areas to do a reasonable risk  
11 assessment.

12 I had planned to give you an example of a site-specific risk  
13 assessment for a park site in Montana. But in the interest of time,  
14 I'm going to skip that. The Panel has copies of the slides.

15 And since it is site specific, Montana is very different from  
16 California, for instance. So many of the parameters would only  
17 apply to Montana where it's cold and it snows in the wintertime  
18 and does a lot of other things the rest of the country doesn't do. So  
19 I'm going to skip the next few slides.

20 Let's stop here on this one. The next part that I want to talk  
21 about is the dermal absorption of arsenic from soil. The superfund

1 program has been working on this guidance document for a long,  
2 long time, probably close to 10 years, at least. And it's going to  
3 be published soon as interguidance. And it's called "Risk  
4 Assessment Guidance for Superfund, Part E." That's the regs. Part  
5 E.

6 This document has undergone extensive review by superfund  
7 scientists, regional scientists, as well as headquarter scientists.  
8 There's been one external peer consultation workshop-type setting,  
9 two external peer reviews; and, as I said, it's going to be published  
10 soon. I'm told within a few weeks in the Federal Register for  
11 public because of some of the issues involved with it.

12 But the basic equation is shown there. This is essentially  
13 the same thing that was presented this morning by the Office of  
14 Pesticide Programs. There's a couple of differences between the  
15 way the pesticide program and the superfund program are using a  
16 couple of the input parameters to this equation that I want to draw  
17 your attention to. So can I have the next slide.

18 The two things that are really different are the adherence  
19 factor and the absorption fraction of how much arsenic goes  
20 through the skin. So those are really the only two parts I'm going  
21 the talk about.

1       The first one, the adherence factor. And a very early version  
2       of this guidance document -- I think it was 1989 was the date --  
3       had a much higher value for the adherence factor of soil to human  
4       skin. That value was the 1.5 milligrams per square centimeter that  
5       was mentioned this morning.

6       The most recent -- well, all of the recent versions of this  
7       document have used this lower value, the 0.2 milligrams per  
8       square centimeter. This is for dry soil. The higher value comes  
9       from some studies with commercial potting soil.

10       The superfund program has recommended using these lower  
11       values either for 0.2 for the reasonable maximum exposed child or  
12       0.04 milligrams per square centimeter for the central tendency.  
13       Because the superfund program thinks that this soil type is most  
14       representative of the types of soil, dry soil, found at superfund  
15       sites across the country, that may or may not apply to a residential  
16       setting or areas, some parts of the country, that have soil that has  
17       more of the characteristics of potting soil.

18       Most of the superfund sites that I've seen, particularly in  
19       Region 8, it's very dry. It doesn't rain very much. It's mostly  
20       decomposed rocky mountain. It doesn't have much organic matter  
21       in it. And it's very dry and probably doesn't stick as much to skin

1 as commercial potting soil would.

2 So there's a significant difference in the numbers there. If  
3 you were just to run the numbers through the equation, you'd get a  
4 sevenfold difference in the amount of arsenic that you would  
5 predict in the systemic circulation with those two different  
6 numbers.

7 And the other one is the absorption fraction. We are both  
8 citing the Wester 1993 publication. I've never seen in any of the  
9 versions of this superfund guidance a number other than 0.03.

10 The information that the pesticide program pulled out of that  
11 paper has a range of a high of 6.4 for absorption of arsenic through  
12 skin from a water matrix to lower values from lower soil. And I  
13 think what the superfund program needs to do is to go back and  
14 look in detail at this publication to see which data set would be  
15 most appropriate to use in this guidance.

16 As I said, I've never seen a number other than the 0.03  
17 quoted in these. And I must confess I was not involved in writing  
18 the guidance document for the superfund. I've read through it lots  
19 of times and provided comments. But I've never looked at the  
20 Wester article. And I think the superfund program needs to do that  
21 to try to reconcile what the information that we have from the

1 pesticide programs evaluation of the paper and what's in the  
2 guidance document.

3 So I will sent that message back to the superfund program to  
4 look at that and make sure what is in the guidance, at least the  
5 final guidance, represents accurately what was in the scientific  
6 publication.

7 And I think that's probably all I want to say at this point.  
8 And if there are any questions for the Panel, I'll try to answer them  
9 the best I can.

10 DR. ROBERTS: Okay. Thanks, Dr. Benson. Yes, Dr.  
11 Mushak.

12 DR. MUSHAK: Yeah. I would, you know, support what you  
13 say about the need to use a common soil across animal models. I  
14 wrote a comprehensive paper on this problem in a 1998 issue of  
15 EHP and pointed out that, not only do we have the common, the  
16 problem of no common soils, but we also have no common dosing  
17 protocols.

18 So you had bolus doses being administered with certain  
19 animals, and then you have split doses being administered with  
20 other animals, and then you have small amounts being  
21 administered in split doses. So that if you analyze this all

1 together, it's not clear where the animal is coming in terms of  
2 contributing to the variability. And until we have these, you  
3 know, reducing the number of confounders, we'll never know  
4 really what the animal model contribution is.

5 DR. ROBERTS: Dr. Smith.

6 DR. SMITH: Andy Smith, Maine Bureau of Health.

7 You mentioned that Region 8 has a preference for relying on  
8 the swine as a model for doing bioavailability studies. Can you  
9 just talk to us for a moment of why you have that strong  
10 preference?

11 DR. BENSON: I'm not the best source on this, but I'll do the  
12 best I can. Dr. Roberts could probably give you a better  
13 exposition of this than I could.

14 The model was originally developed to look at the  
15 bioavailability of lead, primarily from paint chips, superfund site  
16 soils, and other sources. And it worked very well for the lead  
17 model. And since the Region 8 people had experience using that  
18 model, they had a standard animal that they used, the immature  
19 swine as opposed to the mini pig, and had a dosing protocol that  
20 worked quite well for lead.

21 They just adapted the model to try to measure arsenic,

1 bioavailability of arsenic, across various superfund sites. And  
2 there were a number of problems with getting recoveries adequate.  
3 Arsenic was lost in the process that was solved recently with the  
4 addition of a manganese magnesium chloride, I believe, to the  
5 reflux solution.

6 So it's primarily the preference is historical, you know,  
7 historical use. They're used to the model. They've got a  
8 laboratory that can routinely do the analyses and get reproducible  
9 results now for arsenic. But they have not made a comparison of  
10 different animal models. That really needs to be done.

11 DR. ROBERTS: Yeah, I would agree with Dr. Benson's  
12 comments. That's my understanding of the preference for that  
13 model.

14 DR. SMITH: Okay. The second question is: Did I  
15 understand correctly that is it Region 8 or superfund or who are  
16 you representing has a preference for these lower -- what was it --  
17 adherence factor?

18 DR. BENSON: The soil adherence factor.

19 DR. SMITH: The soil adherence factor.

20 DR. BENSON: That's the general superfund program  
21 guidance. Region 8 doesn't have a position one way or the other.

1 But it's the National Superfund Program Guidance document that  
2 that was referring to.

3 DR. SMITH: And this is for the draft one; is that right?

4 DR. BENSON: It's going to be published as draft or interim  
5 guidance for public comment shortly.

6 DR. SMITH: Uh-huh. And, again, the thinking of that is it's  
7 perhaps more representative of the average sort of soil one is  
8 going to run into across sites.

9 DR. BENSON: More than commercial potting soil. I think  
10 is more representative than -- well, dry soil is more representative  
11 of a superfund site than commercial potting soil.

12 DR. SMITH: Any thought in how we should think about that  
13 if we find ourselves wondering about scenarios where it's the  
14 buffering material and so we're no longer probably talking about  
15 soil beneath playground structures? Or at least in my neck of the  
16 woods, it's going to be wood chips, probably hardwood, or it's  
17 going to be very fine sort of a cedar-type mulch or things like that.

18 DR. BENSON: I would not think the superfund program  
19 would have any advice for you on that at this time.

20 DR. ROBERTS: Okay. Are there any questions for Dr.  
21 Benson? If not, thank you very much, Dr. Benson.

1           Well, I think we should all take a deep breath. We have  
2           completed the various presentations. And let me say at this point  
3           that I would like to thank all of the presenters. I think that we got  
4           a lot of material over a fairly short period of time before this  
5           meeting. I think it was very difficult for the Panel to digest all  
6           this material in advance. And the various presentation, I think,  
7           have helped a lot in terms of laying out the issues and the pros and  
8           cons associated with that.

9           I would really like to thank all of the presenters for their  
10          presentations and their patience in answering our many questions.

11          We are finally at the point in the agenda where we begin to  
12          discuss and provide some feedback to the Agency on the various  
13          questions that they have posed to us.

14          I would like to go ahead and begin with the first question  
15          and would ask the Agency if they could read the question and pose  
16          it to the Panel, please.

17          DR. MCMAHON: Assuming you remember all of this from  
18          yesterday, I can go ahead and just ask the question.

19          DR. ROBERTS: Fire away.

20          DR. MCMAHON: Our first issue is related to the short- and  
21          immediate-term endpoint selection for inorganic arsenic.

1           Our question to you is: "Please comment on the Agency's  
2           selection of the 0.05 milligrams per kilogram per day LOAEL  
3           value for use in assessing risks to the general population as well as  
4           children from short-term and immediate-term incidental oral and  
5           dermal exposures and the appropriateness of the use of an  
6           uncertainty factor of 100.

7           "Please provide an explanation and scientific justification  
8           for your conclusions as to whether the presented data are adequate  
9           or whether other data should be considered for selection of this  
10          endpoint."

11          DR. ROBERTS: Thank you. Dr. Bruckner, can you lead off  
12          our discussion on this question.

13          DR. BRUCKNER: All right. My name is Jim Bruckner. I'm  
14          going to try to set a precedent here and that is I'm going to be  
15          hopefully -- hold me to it -- fairly brief and to the point.

16          First thing I want to do is compliment Bob Benson. This is  
17          the second of his documents I've reviewed in the past couple of  
18          months, that is his Region 8 document, which I sort of relied upon.

19          I guess the first question is about the LOAEL, the selection  
20          of that point. I was struck, as I read his document, by the  
21          consistency in that from one study to another, from one population

1 to another, under very different conditions.

2 I had a problem a little bit with some of the key studies that  
3 you relied upon, that is the Mizuta Study. I guess, you know, this  
4 has been expressed before the question of what the dose really was  
5 and how accurate that was. But it did come up with a .05  
6 milligram.

7 And then that second study by Francsblau (ph) and Willis,  
8 I'm again, that's a rough approximation. But you still end up in  
9 the same ballpark. And like I said, I've looked at other studies.  
10 There were a lot of studies which came up with the same LOAEL. I  
11 looked at the Mizuta study, and I think this is sort of where I'm  
12 heading.

13 The .05 I see as sort of a starting point, but I think I would  
14 like to refine that a little bit. And I'll give you my reasoning. The  
15 Mizuta Study, of course, was about 1,100 children; and the  
16 NOAEL, according to that study, was a little bit less. It was .015.

17 I felt fairly comfortable with that study and with the Chinese  
18 study in Taiwan with 14,000 children where the LOAEL, I think,  
19 was about .06 milligrams per kilogram.

20 So having said that, I feel a little more comfortable with  
21 lowering that LOAEL somewhat perhaps using a NOAEL. And

1 then I want to tell you what I'm uncomfortable with.

2 I'm uncomfortable with using a factor of one or three here  
3 for a couple of reasons. In the Mizuta Study, we're talking about  
4 just being on the threshold or beyond the threshold for some fairly  
5 serious effects. We're not talking about just skin lesions, but  
6 we're talking about, as I remember, there were some paraesthesias,  
7 some GI bleedings, some things like that which I think are fairly  
8 serious effects. That gives me reason to think there should be  
9 more of a safety factor.

10 Another problem I have -- I guess I'd like to ask a question.  
11 I'm not sure if you have enough information, despite all of these  
12 studies, to have any idea what the shape of the dose response curve  
13 might be. Or phrased another way: Do you have any assurance  
14 from animal studies how steep or how flat that dose response curve  
15 would be?

16 VOICE: I think if I could respond. Oh, I don't have specific  
17 information, but I just would echo your comment that I felt that  
18 the studies in the human case reports and epidemiology studies  
19 showed a fairly consistent level of exposure whether or not you  
20 had questions about the actual dose received. But I don't have  
21 specific data with me right now in the animal studies for the dose

1 response.

2 DR. BRUCKNER: I was just wondering for any toxic effect  
3 not if you have it with you. But I'm just wondering if you could go  
4 back and look and see how steep for any effect the dose response  
5 might be. I know you're not going to have it in humans, but you  
6 have it in animals. That would give me a little bit more assurance  
7 to vote for a larger or smaller uncertainty factor.

8 VOICE: Okay.

9 DR. BRUCKNER: And then the last thing I'm concerned  
10 about is with the neurological effects, which arsenic obviously  
11 has. It probably comes back to my time on the kids's committee or  
12 pesticides in diet -- with some children.

13 But I'm concerned since it does have neurological effects.  
14 My impression is, from most all these studies, that neurological  
15 effects were really never looked for. And so they may have been  
16 there; they may have been not. And there probably wasn't any  
17 follow-up on those studies either to determine whether those  
18 effects, if they were there, persisted.

19 So this just gives me -- I'd like to sort of raise this as an  
20 issue. It causes me concern that maybe -- and I don't evoke this  
21 very often. Maybe, you know the tenfold factor for children or

1 just a tenfold at least would be appropriate here applying that to  
2 NOAEL would be my vote rather than a LOAEL.

3 And I'll stop with that. I have other points, but I think that's  
4 my major.

5 DR. ROBERTS: Let's pick up the discussion then. Dr.  
6 Francois, would you like to add some comments to that?

7 DR. FRANCOIS: Basically, as I mentioned earlier, I think  
8 there's a lot resting on those two studies with respect to the  
9 formulation of a LOAEL. And, again, the question of those is a  
10 big one. And I don't know how many toxicological studies would  
11 get by in 2001 with the author not really being precise about the  
12 dose that was ingested in those particular cases.

13 In addition to that, there's no mention of other sources of  
14 exposures, such as drinking water, food, et cetera, which again, in  
15 essence, could really exacerbate those types of symptoms at this  
16 given low dose if there were additional sources of exposure.

17 And I'm somewhat shocked at the number of subjective  
18 symptoms. It seems to me that physicians back then didn't have  
19 managed care to sit there and take this review of symptoms. So  
20 what I tried to do was to sort of correlate the subjective symptoms  
21 with the physical findings on the examination and then try to look

1 at some possible laboratory values that were of interest.

2 And what I looked for I looked at the urine arsenic that's the  
3 given there, and it seems to me that they're reporting urine arsenic  
4 level on a limited number of patients.

5 In addition, some of the symptoms that are listed are not  
6 exclusively unique to arsenic. There's no data on past medical  
7 history on these individuals. So I've had some problems in really  
8 basing any type of decision on this particular study. In  
9 Francsblau, one of the cases there's really no dose for Case No. 2  
10 since there's no water intake given.

11 So I think that with respect to this particular value, it's  
12 really -- I don't have any solid data to -- because the question is  
13 asked to look at those two studies. But as James mentioned, we  
14 sort of went beyond that and tried to seek guidance through other  
15 studies.

16 But what I'd like to propose is to try to get more information  
17 about the specific question that's before us. Namely, that in the  
18 form of a study, looking at children in the playground setting and a  
19 study that would look at, for example, either urinary excretion of  
20 arsenic, arsenic in hair or nail, and have a control group of  
21 children not playing on these structures.

1           To me that would provide a little more objective  
2           information. Because, again, I'm trying to look at this through  
3           some clinical eyes. When a patient comes in, she's 50 years old,  
4           she's got all the risk factors for breast cancer. I don't say, well,  
5           let's go to the OR and do a mastectomy. I do a mammogram and  
6           get more information.

7           Someone comes in and they're bleeding, in the context of  
8           OB-GYN, you would do a pregnancy test, again, trying to get more  
9           information. You could do an ultrasound.

10          Again, all of these would be objective data that would be  
11          obtained in the management of that person. And these are the eyes  
12          through which I'm trying to assess the question before me. So,  
13          therefore, I would like to obtain more information in the form of a  
14          study not based on assumptions but rather on some clinical data  
15          using children.

16          My other point is it seems to me -- I'm in public health.  
17          Maybe I didn't notice that there is perhaps an epidemic of skin  
18          problems in children using playground equipment. And, again,  
19          that's also an issue that needs to be addressed.

20          And, lastly, no one has mentioned potential for structural  
21          failures with other types of equipment. Not that I have any

1 particular stock in CCA wood. But, again, I think it just needs to  
2 be objectively put on the table as well. Thank you.

3 DR. ROBERTS: I believe Dr. Bruckner has a follow-up  
4 comment. And then we'll go to Dr. Steinberg.

5 DR. BRUCKNER: All right. There was one other point, I'm  
6 sorry, I didn't mention that causes me concern about the  
7 possibility of neurological effects.

8 If you look at the mechanisms or supposed mechanisms, you  
9 have problems with transcription, problems with cell division, the  
10 evidence of binding of perhaps methylated forms to DNA. Those  
11 are -- I think I probably have some follow-up for my colleague  
12 across the bench, I hope, about that.

13 But those are just some other reasons that give me a little  
14 cause for concern about neurological effects in the developing  
15 brain.

16 DR. ROBERTS: Thank you. Dr. Steinberg, would you like  
17 to add some comments at this point?

18 DR. STEINBERG: It's good to be third. It's good to have  
19 very astute colleagues.

20 Obviously, the presentations have been very important, very  
21 high quality. I'd like to particularly thank the hard work of the

1 EPA and a number of presenters for all the good work that they've  
2 done.

3 The Mizuta Francsblau France articles have been gone over,  
4 and the large addition of information from Abernathy and Benson  
5 has been mentioned. And I think that LOAEL standard of .05, if,  
6 indeed, it seems to be at this time our best acceptable guess.  
7 Maybe dropping that a little lower for children as LOAEL is  
8 perfectly justified as Professor Bruckner said.

9 An additional tenfold increment related to the work of  
10 ATSDR and the initial work with EPA for adults certainly seems  
11 reasonable. We're in the month of important protection for  
12 children. Christy Todd Whitman told us that October is "Protect  
13 Your Children and Keep Them Safe and Happy in the Environment"  
14 month. And if you go to the EPA web page, that's what you see.

15 And we are duty bound to do that. We have high uncertainty  
16 as it relates to CCA and children. We have to make sure that we  
17 are protecting developing minds as best as we can. The  
18 neurotoxicology is an extraordinary data gap. We have amazing  
19 amounts of no information as it relates to CCA, as it relates,  
20 indeed, to arsenic and the brain.

21 Given that, we must be especially cautious when we look at

1 protecting children and looking at making sure that we make the  
2 smallest amounts of these agents available to children. There's no  
3 question that we're dealing with populations that are at special  
4 risk. And we have to take due course in protecting them, also.

5       There's also no doubt that we have to apply the best science  
6 and technology that we have. The initial article's by Mason and  
7 others that -- now show that, certainly, arsenic may interact with  
8 DNA, that chromium through indirect mechanisms of oxygen  
9 radicals may also attack DNA. Those are very important  
10 opportunities of mechanism and biomarkers. We have begin to  
11 look into that.

12       I would ask my good colleagues at EPA to talk to their  
13 buddies at ORD and see if we can get ORD both interested and  
14 involved in some of these.

15       There is also no question that these are not only an issue  
16 related to cancer, but more importantly, they are  
17 neurodevelopment issues; they are developmental issues of  
18 growing fetuses. It's something we have to thinking about. Of  
19 procreating adults, we have to have worries about this.

20       We clearly await further clarification from the EPA studies  
21 that they'll do in playgrounds and, of course, they should be fully

1 empowered to do a complete risk assessment and look at  
2 cumulative risk and multiple types of stressors that are involved.

3 There's no doubt that, even if we talk about what levels of  
4 CCA or what levels of arsenic we're going to make available to  
5 people and young children, there's no question that this material  
6 stays in the environment and recycles back and may come back to  
7 us.

8 Therefore, obviously, alternatives to CCA have to be looked  
9 at. The material from Dr. Stillwell was, to me, very riveting. The  
10 material presented, also, on mulch was very worrisome.

11 DR. ROBERTS: Dr. Steinberg, I am sorry to cut you off.  
12 But we're going to have time for you to raise the points about  
13 aggregate risk assessment. And I really want the Panel to focus  
14 specifically on Question 1 now. Again, I want you to have the  
15 opportunity to raise those points, but I think it's going to come.

16 DR. STEINBERG: I hear it. I have two more points. I will  
17 finish quickly.

18 I'd like to, also, make sure that we have consumer  
19 information related to this; and, of course, there must be full EPA  
20 oversight as it relates to this matter.

21 I am done.

1 DR. ROBERTS: Thank you, Dr. Steinberg.

2 I'll open this now for comments from other members of the  
3 panel. I believe Dr. Gordon had his hand up. And then we'll go to  
4 Dr. Mushak.

5 DR. GORDON: My hand was just up to encourage people to  
6 be short. That was all.

7 DR. ROBERTS: And you've made that point very succinctly  
8 as exemplifying your point. Dr. Mushak.

9 DR. MUSHAK: I'll assume the sequence was accidental.

10 I have a question about why EPA and some of the lead  
11 discussants are ignoring the Morinaga Infant Poisoning episode in  
12 Japan. Everybody is concerned about children and their  
13 differential sensitivity versus adults. Here we have a body of  
14 poison victims. I think we need to get that information from --  
15 they're four clinical publications that look at the different  
16 endpoints and the different exposures.

17 And then there's a 1973 Japanese Pediatric Society  
18 follow-up that looked at what are the long term effects.

19 And one thing is found in these infants is that a lot of them  
20 sustained persistent, neurological sequelae, including clinical  
21 retardation, more subtle aspects of retardation, behavioral

1 problems, et cetera.

2 The only information that's readily available to the panel on  
3 that population is the Mizuta paper. And all they say in passing  
4 reference is there are like  
5 3.5 milligrams per day over 33 days. Well, that works out for a  
6 10-kilogram infant as a rough measure that's not terribly helpful  
7 for setting a LOAEL. That's a .35 milligram per kilogram.

8 But that integrates within it fatalities, comas, severe  
9 damage. I think EPA ought to at least spring for a translator to get  
10 all that information out of the Japanese literature. I mean, these  
11 are infants.

12 DR. ROBERTS: I believe Dr. Chen from the Agency can  
13 respond to your comment.

14 DR. BENSON: Dr. Roberts, can I respond as well?

15 DR. ROBERTS: Sure.

16 DR. BENSON: We looked at that paper in detail. We have a  
17 translation of it. The reason that at least the document that I wrote  
18 that it wasn't included is because the exposure was so high that  
19 there were such serious effects and deaths that it was not  
20 appropriate to use to set a lowest observed adverse affect level.  
21 But we've got the data.

1 DR. MUSHAK: Yeah. So there's no way to stratify the --

2 there's no dose stratification that can be done --

3 DR. BENSON: No.

4 DR. MUSHAK: -- in any of those papers.

5 DR. BENSON: No. And there's a lot of discrepancies, at  
6 least in the paper that we have, in terms of the numbers of infants  
7 that were affected. But the doses were roughly 10-times higher  
8 than what was in the Mizuta paper.

9 DR. MUSHAK: So they were on the .5, .6 ballpark.

10 DR. BENSON: Somewhere in that range.

11 DR. ROBERTS: I believe, Dr. Kosnett, did you want to...

12 DR. KOSNETT: I just want to follow-up. Bob, I haven't  
13 been able to get a translation of the Moranaga paper. I just have  
14 an abstract. I'd love to read it.

15 DR. BENSON: I've got one back in Denver. I left it there.

16 DR. KOSNETT: But it's interesting that Mizuta says that the  
17 dose was 3.5 milligrams a day. That was to infants. So on a  
18 milligram per kilogram basis, it would be considerably higher.

19 DR. BENSON: Higher.

20 DR. ROBERTS: Before I lose control here, Dr. Chou had a  
21 follow-up, and then I believe Dr. Clewell was next in line to make

1 a comment.

2 DR. CHOU: Regarding the Moranaga study, when they first  
3 published it, I wonder was the exposure defined although I  
4 understand it has been estimated. My question is: When was it  
5 estimated, and how was the dosage estimated?

6 DR. BENSON: If I remember correctly, it was from --  
7 arsenic was in dry powdered milk, dry milk. And they eventually  
8 got samples of the dry milk. And they measured the concentration  
9 of arsenic in the sample and then estimated how much formula  
10 would -- how much would have ended up in a typical formula for  
11 the infants and how much a typical infant in Japan consumed per  
12 day.

13 DR. ROBERTS: I'm sorry. Dr. Chen, I didn't give you the  
14 opportunity to comment. Did you have anything to add to what Dr.  
15 Benson's description of why the study was not --

16 DR. CHEN: We go over that study, and the reasons that we  
17 didn't put that one into our consideration is the same as Dr. Bob  
18 Benson mentioned.

19 DR. ROBERTS: Okay. Thank you. Dr. Bruckner, did you  
20 have a follow-up before we get to Dr. Clewell?

21 DR. BRUCKNER: Yes, I did. What were the ages of the

1 infants, do you know, approximately?

2 DR. BENSON: They were newborns, one month old up to a  
3 year old.

4 DR. BRUCKNER: One thing most everybody realizes, I  
5 think, is that newborns, in the first weeks, are very, very different  
6 from children in most every respect in terms of absorption,  
7 pharmacokinetics, and metabolism, most everything. So that's a  
8 very different population from children.

9 DR. ROBERTS: So it's sounds like there were a lot of  
10 reasons for perhaps for not including it for the purposes of setting  
11 a LOAEL.

12 Dr. Clewell, you're up.

13 DR. CLEWELL: I would just ask everyone to try to be kind  
14 of precise in their language when they're talking about uncertainty  
15 factors because that's one of the most uncertain parts of risk  
16 assessment.

17 If we really believe that there's evidence that children are  
18 more susceptible to the acute and subchronic effects of arsenic  
19 based on some data, then we should, indeed, have a child safety  
20 factor.

21 But you'll see in the way that the EPA has embraced the

1 notion of the safety factor for children that they still fit it within  
2 their frame work. And it's based on some evidence that it's needed  
3 and that they don't routinely use one just because they're  
4 concerned about child exposures. We're all concerned about child  
5 exposures. I've got grandchildren.

6 But we try to be organized in the way that we assign  
7 uncertainty factors to chemicals so that it isn't just a matter of how  
8 afraid we are. So if you actually -- I didn't really see any evidence  
9 that there's any basis for believing that children are more  
10 susceptible. Certainly, you can always speculate. But I didn't see  
11 any evidence of it, particularly not in the study that has been  
12 discussed as the potential basis.

13 Both of these studies also -- well, the second study that was  
14 mentioned, the drinking water episode, even though it's only two  
15 people, there's an excellent dosimetry information to be able to  
16 reconstruct exposure, not only the drinking water levels to which  
17 they're exposed but the urinary levels for both individuals with the  
18 time of events when they stopped drinking water, what the  
19 concentrations were. You know, there's a human arsenic model.

20 As a matter of fact, you can just use Buchet's original  
21 volunteer data and you can actually tell what the exposure of these

1 people was.

2 And between that and comparison of the urinary levels in  
3 that and the Mizuta study, you can probably do a good job of  
4 estimating what the actual exposures were instead of having to  
5 rely on the authors estimates of soy ingestion.

6 So I think that there are a number of things to be done to try  
7 to be a bit more precise here in terms of what were the actual  
8 exposures, what is the evidence that there's a need for a  
9 child-specific uncertainty factor.

10 I understand the concern about the significant nature of the  
11 effects that were observed so that perhaps the LOAEL to NOAEL  
12 should be more than 10. That doesn't mean that we're putting in a  
13 child safety factor. That means we're putting in a NOAEL to  
14 LOAEL greater than 10. That's different even though you might  
15 get to the same place. Why you're getting there is important. Why  
16 you say it's necessary to use a certain factor.

17 So I'd appreciate when people are talking about what they  
18 feel comfortable with for a factor, if they would kind of mention a  
19 factor of this for this reason, a factor of this for this reason, and  
20 giving a total of some value. Thank you.

21 DR. ROBERTS: And having said that.

1           And I agree with what you said. I think the Agency  
2           ultimately would like some feedback. I could stand to be corrected  
3           from Dr. Vu in just a second. But the way the question is posed  
4           and I read it is I think they wanted to know whether 05 as the  
5           LOAEL is a reasonable place to start and whether or not what we  
6           sort of thought about the uncertainty factors that ought to be  
7           applied if that's the case to come up with a reference dose.

8           DR. CLEWELL: I have to admit that I would feel that  
9           perhaps something greater than 10 as an uncertainty factor.  
10          Considering the study that is the basis, I would probably plunk for  
11          30 based on the fact that there is some consistence in longer  
12          studies. And even though there may be some tolerance  
13          development with arsenic, I don't see that much evidence for  
14          tolerance development except for the arsenic eaters. And I don't  
15          know if I believe that story.

16          So something on the order of 30 total uncertainty factor I  
17          would guess would be the thing I'd be most comfortable with.

18          DR. ROBERTS: Dr. Vu, are we correctly interpreting what  
19          the Agency would like feedback on this?

20          DR. VU: Well, first of all, let me just clarify a certain point  
21          in terms of the Agency's general practice on how we apply

1       uncertainty factors. And then we'll go specifically on this  
2       particular case.

3             Typically, we use uncertainty factors to account for  
4       interspecies extrapolation. In this case, we don't have to worry  
5       about that because you actually use human data.

6             So with regard to extrapolating across human populations,  
7       when we don't have data, we would use generally the fault  
8       assumption of the factor of 10 that would cover between the  
9       difference my response to your response, a factor of 10. And then  
10      if you have an effect level and you want to find a no effect level,  
11      we apply another factor of 10.

12            So in this particular case, the Office of Pesticide Program is  
13      proposing that if we pick the study, and you have to agree first of  
14      all whether the selection of the study to derive, to select the  
15      LOAEL. In this case, the Mizuta study provided an effect level.  
16      In this case, it is 0.05 milligram per kilogram per day.

17            So if you use the same principle I just mentioned to you,  
18      then you have to use a factor of 10 to go from LOAEL to NOAEL  
19      and another factor of 10 to account for human variability.

20            In this case, which includes children, so it's not specifically  
21      a different factor for child. This is just human variability

1       uncertainty factors. So that would be a total of 100 for this  
2       particular case.

3             And what differs is that the ATSDR used the same study and  
4       did not apply for a factor of 10 to account for variability because I  
5       think, as Dr. Selene Chou explained it in her presentation, that for  
6       screening purposes, they didn't think to use it for factor 10. So the  
7       total factor only used a 10 LOAEL to NOAEL.

8             Dr. Benson also spoke of the same studies that use -- if you  
9       were to pick the LOAEL of 0.05 and the same study as OPP  
10      proposed, only the judgement used only a factor of 3 for human  
11      variability as opposed to the full factor of 10.

12            So again, it's a matter of different judgement. But I just  
13      want to say that OPP's proposal is typical the standard of that  
14      extrapolation. Thank you.

15            DR. CLEWELL: I stand corrected. I forgot to mention that I  
16      didn't feel an uncertainty factor was necessary for human  
17      variability in this case.

18            It's still 30. It's 30 for one, and 10 for the other. And others  
19      can argue that you should have 3 for variability and just 10 for  
20      LOAEL and that would still be 30. I know there's a structure. And  
21      the structure says up to 10 for each one. And, actually, I don't

1 think that the structure would forbid you from making it more than  
2 10 if you felt it was necessary.

3 So what I mostly feel is that the suggestions of the scientists  
4 on this panel should be clear as to how much of a factor they feel  
5 is needed, for what reason, and then the EPA can try to translate  
6 that into their structure.

7 DR. ROBERTS: Dr. Styblo, Dr. Gordon, and then Dr.  
8 Ginsberg.

9 DR. STYBLO: Just one short note. The first question is  
10 about justification of LOAELs for inorganic arsenic. But we want  
11 to apply this LOAEL to CCA which we all know is a mixture of  
12 three metals. What kind of uncertainty level this attempt carries.

13 I'm a biochemist. I deal with metals, metal biochemistry,  
14 and toxicology. Every biochemist that deals with metal will tell  
15 you that there are great differences between these types of metals  
16 that could completely change final effects. As a biochemist, I'm  
17 asking what kind of uncertainty this includes when we apply  
18 inorganic-arsenic based data on CCA mixture.

19 DR. ROBERTS: I guess, Dr. McMahon, would you like to  
20 respond to that?

21 DR. MCMAHON: Well, that's a good question. But what we

1 have to work with is based on actual industry arguments and our  
2 own agreement that we would test arsenic and chromium separately  
3 for the CCA. This goes back to the '80s; and, therefore, the data  
4 that we used, unfortunately, was not with the mixture. And I think  
5 there's probably a lot of questions about mixture toxicology that  
6 still need to be explored.

7 So I can't definitively answer that. You know, there could  
8 be some differences. I'm not really sure where that would fall out.  
9 I would appreciate anyone's advice on that particular topic as  
10 terms of uncertainty between those.

11 DR. STYBLO: I can just tell you that the effects in terms of,  
12 for example, early 50s can differ by three orders of magnitude in  
13 some mixtures of metals. So how this would reflect in the level of  
14 uncertainty. And, again, I don't have answer.

15 DR. ROBERTS: I have Dr. Gordon next. Then Dr. Ginsberg.

16 DR. GORDON: Terry Gordon.

17 I'm comfortable with the .05. The Mizuta study plays  
18 heavily in that. And since -- Dr. Benson, since you seem like you  
19 know the translations in the Mizuta study, to me the biggest  
20 uncertainty factor was the concentration. It said it was estimated  
21 to be .1 milligrams per mil. Do you know how they measured it, if

1 at all?

2 DR. BENSON: There's no information in the paper at all on  
3 how the arsenic was measured in the soy sauce.

4 DR. ROBERTS: Dr. Ginsberg.

5 DR. GINSBERG: Well, I'd like to go back to where Dr.  
6 Bruckner started us off on. I'm not really that much in favor in  
7 endorsing the LOAEL of .05. I'd think I'd rather look at the data  
8 base as a whole.

9 It sounds like EPA is interested in looking at the acute and  
10 the subchronic sort of as one large data base supporting each  
11 other. I think it does generally support each other. And if you do  
12 that, then you can use the -- what's the name of that study?

13 DR. ROBERTS: Masumder.

14 DR. GINSBERG: Right. And find a NOAEL that is  
15 applicable to children, albeit not neurologic based but at least for  
16 skin lesions that is .015 which gets us away from having to use  
17 bigger uncertainty factors than smaller. You know, we can use  
18 less uncertainty in the analysis if we start with a NOAEL of .015  
19 and then think about how we want to layer in the uncertainty in  
20 terms of the lack of neurologic data in that particular cohort. So  
21 we have a NOAEL. But there's a but about that NOAEL.

1           And, also, because of the severity of effects both in  
2           subchronic and acute studies in the .05 to .1 range. So knowing  
3           that we do have concerns, you know, about severity of effect, and  
4           knowing there's an uncertainty, I think you can easily justify a  
5           tenfold factor below the NOAEL which would get you -- Jim didn't  
6           state this -- but would get you down to .0015, 1.5 V to the minus  
7           third milligram per kilogram per day, as sort of the bright line for  
8           acute and subchronic.

9           And I think I'm fairly comfortable with that. And that also  
10          gets us to this thirtyfold range off of that LOAEL. But it gets you  
11          there a slightly different way.

12          My concern with that number is that it's not all that far from  
13          the chronic-based RFD or the chronic oral MRL. And I don't know  
14          if the -- you know, the difference is less than an order of  
15          magnitude. And I don't know of any other chemical. I may be  
16          wrong. I don't have IRIS in front of me. But I don't know of any  
17          other chemical for which one day of exposure is within -- is  
18          significantly less than an order of magnitude different than a  
19          lifetime of exposure in terms of toxic sequelae.

20          And so I think if you do use that number -- and I could  
21          support that number in my own mind -- I think that there has to be

1 some discussion. And maybe it's the effect, you know, the issue of  
2 adaptation to arsenic, looking at the plethora of effects that occur  
3 acutely which may be different than the effects that occur  
4 chronically, so there may be a shifting in terms of types of  
5 toxicity.

6 But looking at the half-life of the chemical so that you're not  
7 getting a buildup, you know, there's no accumulative effect. You  
8 know, to see why acute would be similar to chronic. It would just  
9 help risk assessors in the regions, risk assessors at the state level,  
10 understand why these numbers are uniquely close to each other  
11 from one day of exposure to, you know, 70 years of exposure for  
12 this particular chemical.

13 DR. ROBERTS: Dr. Ginsberg and Dr. Clewell took different  
14 paths but came basically to the same number.

15 DR. CLEWELL: That always happens.

16 DR. ROBERTS: Dr. Kosnett.

17 DR. KOSNETT: Are you saying that you think that the .015  
18 is too high?

19 DR. GINSBERG: Right. The .015 would be divided by the  
20 tenfold factor to get to 1.5 V to the minus third was the proposal I  
21 was hearing.

1 DR. ROBERTS: And, well, hearing from yourself.

2 And if you're pressed to put a label on that tenfold, that  
3 would be the intraspecies variability fall into that category.

4 DR. GINSBERG: That would be -- right. Uncertainties  
5 about children's risk in terms of not all the endpoints measured in  
6 that study and also the severity of effects.

7 DR. ROBERTS: Dr. Kosnett.

8 DR. KOSNETT: You're saying a NOAEL of 1.5 micrograms  
9 per kilogram per day essentially.

10 DR. GINSBERG: .015.

11 DR. ROBERTS: Fifteen micrograms or .015 milligrams per  
12 kilogram.

13 DR. GINSBERG: Right. So it's 10.5 -- 10.5 micrograms.

14 DR. KOSNETT: Fifteen.

15 DR. ROBERTS: Fifteen.

16 DR. KOSNETT: But I thought you expressed the concern  
17 that that level was so close to the subacute and acute level and  
18 then you wondered why they were so close.

19 DR. GINSBERG: And divide that by 10. Then we divide  
20 that by 10 to get to a safe level.

21 DR. KOSNETT: So a safe level should be tenfold below the

1 NOAEL.

2 DR. GINSBERG: Right.

3 DR. KOSNETT: And call the NOAEL .015 milligrams per  
4 kilogram.

5 DR. GINSBERG: Right.

6 DR. KOSNETT: I just wanted to understand where you were  
7 coming from.

8 I had just actually a few comments about the data base and  
9 how we can try to gain some useful information from it. You  
10 know, certainly the Mizuta study is important. I think many  
11 people have talked about the uncertainties inherent in the dosing.  
12 And that's true most of these studies. And, in fact, in some  
13 respects, since it was a single-source item, you know, maybe,  
14 maybe they had a better than other studies in terms of how much  
15 they took.

16 But nevertheless, I think it's safe to say there's probably a  
17 range of exposures. If we look at the five patients for which they  
18 had urinary arsenic concentrations, the levels are such about five  
19 to ten days after they stopped using it that those patients probably  
20 took in more than 3 milligrams a day.

21 But as my colleague here would probably say, Peter, just as

1 some data sets usually have some people on the high side, some  
2 data sets have people on the low side. And it's conceivable that  
3 there are also some doses that were less than 3 milligrams a day.

4 In terms of the -- much has been said earlier, and I raised  
5 this in a question with Joyce Tsuji, who spoke to us earlier, about  
6 the issues of the severity of effects and what type of margin of  
7 exposure we should have with respect to the severity of effects.

8 If you look at the kind of symptoms they had in Mizuta, 80  
9 percent of the patients that they commented on complained of  
10 anorexia; 60 percent had nausea, 30 percent had vomiting; and  
11 about that much or perhaps a little bit less had diarrhea. But about  
12 61 percent had some edema of the eyelids which has been  
13 described in other subacute exposures as well.

14 What exactly the pathophysiology of that is and whether that  
15 represents some diffuse capillary-type problems, leak, has been  
16 described in very high dose arsenic exposure is not really clear to  
17 me.

18 Then mentioned muscle tenderness, and slightly under 20  
19 percent of the patients a loss of patella reflex. And this might  
20 represent a form of peripheral neuropathy, although not a severe  
21 one. And they commented that about 50 percent of the subjects

1 had a decrease in their hemoglobin by the second week of the  
2 evaluation.

3 So we have some classic multisystemic findings that have  
4 been seen in other arsenic studies. One thing that was interesting  
5 that they commented on is that 4 of 20 subjects on whom they did  
6 electrocardiograms had a prolongation of the QT interval.

7 This is interesting. Because in other studies in which people  
8 have taken slightly to quite a bit more arsenic in the acute or  
9 subacute settings, there has -- it's well-documented that there is  
10 prolongation of the QT interval.

11 And in fact, in recent experience using approximately 10  
12 milligrams of arsenic a day intravenously in the treatment of the  
13 patients with acute promyelocytic leukemia, there have been  
14 several reports of prolongation of the QT interval. And, in fact,  
15 that has led, and I believe in as many of five patients so far  
16 documented, torsade de pointes, which is a type of atypical  
17 ventricular tachycardia, and in a couple of reports in the past two  
18 years that have been published, this was a fatal outcome. The  
19 patients could not be resuscitated from it.

20 So when you see prolongation of the QT interval in the  
21 Mizuta study, although no one apparently died -- no one did die of

1 malignant arrhythmia -- it still gives you some concern that you  
2 are bordering potentially on an effect that is life threatening if it  
3 were to get a slightly bit higher. And so you may not have a big  
4 margin for that potential outcome.

5 And by the way, it was interesting they repeated the  
6 electrocardiograms in the Mizuta study, and they said the  
7 prolonged QT interval was no longer found. So that was one  
8 particular finding that I thought was particularly noteworthy.

9 Now, are there any historical things we can look at in the  
10 literature that haven't been cited in Bob Benson's document? And,  
11 Bob, I think it's a very nice document. But there are a few things  
12 that we could perhaps supplement in it. And I don't have all the  
13 primary literature here with me; although I've read most of it.

14 As probably most of you know, there was a major outbreak of  
15 arsenic poisoning at the turn of the century in Brittain called the  
16 "Manchester Beer Epidemic."

17 And what happened there was that the beer that was made  
18 was made from some invert sugar. And to invert the sugar, they  
19 treated it with sulfuric acid. And the sulfuric acid came from  
20 pyrites in the Pyrenees that was contaminated with arsenic. And  
21 there were several thousands people who became ill, and there

1       were some deaths.

2               The beer was found to have between 1 to 4 milligrams per  
3       liter of arsenic as analyzed, actually fairly carefully by a chemist  
4       by the name of Dellafeene (ph) and some others. And this is very  
5       well documented in the Royal Commission, the Report of the  
6       Royal Commission, which I happen to have a copy of. It's about  
7       400 pages. And it was probably the best document on chronic  
8       arsenic poisoning at that time in the world.

9               One of the things that they, also, documented in these  
10       subjects was peripheral neuropathy. And, also, a interesting  
11       finding that has shown up in many places is the appearance of  
12       herpes labialis.

13              And this has been another thing about at these particular  
14       doses, in fact, I think it was reported in the Mizuta study as well.

15              And there's been -- arsenic has been used classically for the  
16       treatment of things like asthma. And it's believed to have  
17       potentially some suppression of inflammation of the immune  
18       system. And it's interesting to see that, in the beer epidemic and  
19       other cases like this, herpes has come forward as a side-effect in  
20       some people.

21              The other big incident that has some information is -- not

1 incident but... Arsenic has been used in the form of Fowler  
2 Solution as a therapeutic agent. It was originally described by  
3 Thomas Fowler in 1780, although he's not responsible for it  
4 because he was a physician at the hospital and he saw that a lot of  
5 people were getting these patten medicines and coming into his  
6 clinics. He was wondering what they were taking.

7 And then he went around the corner to the patten, to the  
8 shop, and bought it, a nonphysician's office. And then had it  
9 analyzed, and he found out it was arsenic. And he made his own  
10 and he wrote about it and it's named after him.

11 But it basically -- when he originally used it, he gave 11.4  
12 milligrams a day. And his first -- I think of his first 242 patients,  
13 he said that saw improvements in things like fever -- and probably  
14 rheumatic fever -- he was treating in about 220-some odd of those  
15 patients. But he said that a third of his patients had either nausea,  
16 vomiting, or abdominal pain.

17 Nevertheless, because the drug was thought to have some  
18 therapeutic benefit, in fact, it really became a mainstay of a lot of  
19 therapy from the 19th Century up until the mid 20th Century. It  
20 was on the U.S. Pharmacopeia. I think it got off the U.S.  
21 Pharmacopeia about mid century, 20th Century.

1           It was customarily given in a dose of between 5 to 10  
2           milligrams. Interesting, there was actually a controlled study of  
3           the use of arsenic in the treatment of asthma performed at Harvard  
4           University by Hartner and Novich in, I think, it was in the late  
5           1960s. And they gave between 5 to 6 milligrams per day to adults.  
6           And they said one-fourth of their patients had gastrointestinal side  
7           effects.

8           And that fits in. Essentially, it's a pattern that in the range  
9           of anywhere from 5 milligrams or so, give or take a few  
10          milligrams, people who have received it on a subacute basis had  
11          adverse side-effects anywhere from gastrointestinal things being  
12          commonly reported to potentially some of these other things like  
13          the QT prolongation, which is concerning.

14          And if we look at what Bob has written up, Bob Benson, it  
15          falls in pretty much with close to what you said about .05  
16          milligrams per kilogram per day for being a dose where you can  
17          see these effects.

18          But because of the uncertainty in the exact doses and  
19          because of the subtly and nonspecificity, I think we have to be  
20          concerned that that is not, you know, when we call it a LOAEL,  
21          that's doesn't mean -- that's what -- those are the numbers that

1 have been reported. It doesn't mean that some of these symptoms  
2 just begin at that. I mean, that's probably the central point of  
3 where these effects emerge.

4 And some people, they might emerge at somewhat lower  
5 doses. So I really think it would be -- it's very well justified to  
6 put a safety margin below that as to where the first effects might  
7 particularly appear.

8 Finally, with respect to the chronic exposures, the Mizuta  
9 paper has been cited. The concern I have about over-relying on  
10 that one particular paper is the fact that, although this study has  
11 considerable merit to it in the fact that it's one of the largest  
12 studies done in recent times to do full examinations on people, I  
13 think there were several -- what? -- 6,000 or some subjects.

14 The dose reconstruction in here is not -- was not done very  
15 precisely, I don't believe. In fact, although the authors have put in  
16 dose ranges in terms of micrograms per kilogram per day, it's  
17 reported in terciles. And the actual -- there is no actual reporting  
18 on the volume of water that these specific cases took.

19 And although I think they had some general ideas, I think  
20 there was not a detailed volume assessment done to the extent that  
21 we wouldn't want to -- we would want to treat this -- we'd be very

1 careful to treat it in quantitative terms as to the microgram per  
2 kilogram per day.

3 If we look at other places around the world where there's  
4 been skin lesions described, probably we can, also, look in terms  
5 of Chile and Argentina. And Claudia Hopenhayn-Rich, when she  
6 was there, has certainly been down there and done some studies  
7 there.

8 But, Claudia, in your study, in Argentina, the high area had  
9 about a hundred, averaged 178 micrograms per liter. And I think I  
10 know that there were some areas that were higher and some areas  
11 were lower. And, you know, I'd like to hear your comment as to  
12 what might have been, you know, really typical of the areas.

13 But we need to bear the history of that area in mind. That  
14 area came the light in the early 20th Century because of this  
15 peculiar and distinctive skin lesion that these people had. And if  
16 we assume roughly that 200 micrograms per liter was involved and  
17 we assume that people consumed two liters and we divide that out  
18 by typical adult body weight, what would we get?

19 We would get 400 micrograms a day divided by 70, would be  
20 5 micrograms per day, 5 micrograms per kilogram grams per day,  
21 which is lower than .05 micrograms -- or .015 milligrams per

1 kilogram per day or lower than 15 milligrams per day.

2 And, in fact, if we take the lowest -- if we go to the  
3 Taiwanese study, they EPA assume -- what? -- .17 milligrams per  
4 liter in the water in the low area. Now they multiplied that by 4.5  
5 liters which was the amount that has considered by some, but not  
6 everyone, to represent the amount that adult men consumed.

7 But even in the EPA guidance or EPA memos have said that  
8 the female didn't consume 4.5 liters per day. The adult females  
9 consumed three liters per day and in that three liters we would  
10 include a liter for cooking water. So if you multiply that out you  
11 get less than .015 milligrams per kilogram per day.

12 And I think if we believe -- granted, there are uncertainties  
13 and we don't have time to even talk about the uncertainties in the  
14 dose assessment in the low groupings in the same study.

15 But nevertheless, if you would say that around that area,  
16 around that range, around 200 micrograms per liter of arsenic in  
17 water, there were skin lesions, that will probably be less than .015  
18 in terms of a chronic NOAEL.

19 DR. ROBERTS: But just to jump in, I don't think that's  
20 being proposed as a chronic. I think it's being proposed as a  
21 subacute or intermediate exposure --

1 DR. KOSNETT: Well, the documents that we've been asked  
2 to comment on include both -- at least Bob's document talks up to  
3 years of exposure.

4 DR. ROBERTS: Yeah. And there is information and there  
5 is, in fact, a chronic reference dose. And I think the exercise  
6 they're going through here is to try and develop a reference dose  
7 for exposure periods that are shorter than that.

8 DR. GINSBERG: Can I follow-up?

9 DR. HOPENHAYN-RICH: Can I just answer to the --

10 DR. GINSBERG: Sure. Go ahead.

11 DR. ROBERTS: I think Claudia has been shifting her body  
12 weight ever since you cited her study. So let's let her jump in real  
13 quick on that and then let's try and sort of --

14 DR. HOPENHAYN-RICH: Yeah. I just want to clarify a  
15 little bit the difference between some of the early reports in  
16 Argentina in the area of the Providence of Cordoa (sp) where all  
17 the cases with skin lesions that were clearly attributed to arsenic  
18 exposure were found.

19 The difference between those cases and the study that we  
20 conducted, which was an ecological study by areas in that same  
21 province in which we divided all the counties into high, low, and

1 medium -- high, medium, and low exposures. And the exposure  
2 that we derived from the high exposure group was based on the  
3 available data that we could find on water levels.

4 But what I want to clarify is that we were looking at bladder,  
5 lung, and kidney cancer rates and not at the exposure of the cases  
6 that had skin lesions. The exposures in that area range from zero  
7 -- well, the reported detection limit that the public water company  
8 had at the time was 40 micrograms per liter. And so the levels  
9 were -- from the data that we found were from less than 40  
10 micrograms per liter up to the 4,000 or 3,800 micrograms per liter.

11 So it's really hard or I would just caution in making the  
12 comparison between our study and all the documented cases of  
13 skin lesions.

14 DR. ROBERTS: Dr. Kosnett, I guess I'm trying to distill  
15 your comments. I'm gathering the impression that you think an  
16 examination of some other studies that perhaps were not included  
17 might lead to a lower LOAEL value than .05; is that correct?

18 DR. KOSNETT: Well, I was making a distinction between a  
19 few more exposure and a few years of exposure. So when I  
20 initially -- the first part of my comments were talking about .05 in  
21 terms of a few months of exposure, from a few days to up to a few

1 months. But when we were looking at the EPA document that we  
2 were provided and suggested the level of .015 for a longer term  
3 exposure up to several years, I think the document --

4 DR. ROBERTS: Yeah, actually, I think once you get over --  
5 well, it depends on the program -- seven years up, you would go to  
6 a chronic reference dose; is that correct?

7 DR. KOSNETT: Well, --

8 VOICE: Well, for a superfund, that is correct.

9 DR. ROBERTS: For a superfund. And OPP it's a shorter  
10 period?

11 VOICE: Six months, over six months.

12 DR. ROBERTS: Over six months you would use the chronic  
13 or reference dose which is 3 to the minus 4, if I'm not mistaken.  
14 And I believe we're not being asked to comment on that. They're  
15 trying to come up with a reference dose that can be --

16 DR. KOSNETT: For up to six months.

17 DR. ROBERTS: -- used for up to six months worth of  
18 exposure.

19 DR. KOSNETT: That's correct.

20 DR. ROBERTS: Just to clarify that for the Panel.

21 DR. KOSNETT: All right. Then bear in mind that my

1        comments about the .015 pertain to a longer period of time as  
2        discussed in the document that Dr. Benson and others worked on.

3            DR. ROBERTS: Dr. Wargo.

4            DR. WARGO: I'll be very brief. I wanted to make a couple  
5        of points. One is that I find that the absence of testing of the  
6        mixture CCA to be quite persuasive to me to be caution about this  
7        choice.

8            The second point that I wanted to make has to do with the  
9        absence of developmental neurotoxicity testing. And looking back  
10       over the history of lead, I think lead is probably our best example  
11       of the kind of error that's possible to make in this area.

12           And then thinking about the institutional history of this  
13       group in suggesting to EPA over the past three or four years in  
14       panels that I've participated in, encouraging the Agency to request  
15       DNT data on pesticides, which you have gone ahead and you've  
16       done. And it's in the process of being put together and being  
17       submitted to the Agency. And I applaud that move.

18           But still for the vast majority of pesticides, we don't  
19       understand that effect. That is to me, also, very persuasive to  
20       proceed very cautiously here. Thank you.

21           DR. ROBERTS: And at this juncture, would you want to

1 express that caution in quantitative terms or just prefer to have it  
2 as a qualitative statement.

3 DR. WARGO: At this point I think I would rather leave it to  
4 the people that are the toxicologists.

5 DR. ROBERTS: Thanks, Dr. Wargo. Let's see, I have now  
6 Dr. Chou, Dr. Bruckner, Dr. Bates.

7 DR. CHOU: Since I, also, mentioned the metal interaction  
8 yesterday, I thought I need to clarify that. The interaction I  
9 mentioned yesterday between zinc and copper and zinc -- selenium  
10 and -- no, arsenic. It's getting too the late in the afternoon.  
11 Between arsenic and zinc and arsenic and copper, these evidence  
12 are only showing in animal models. We all know, even for arsenic  
13 itself, we don't have good animal data yet.

14 So my point is we are not ready to take this into  
15 consideration in this round of risk assessment. And, however, it is  
16 probably it's a recommendation for future research. So I just want  
17 to put this to rest.

18 DR. ROBERTS: Thank you. Dr. Bruckner, I know you had  
19 your hand up a moment ago. Did you want to comment again or  
20 add to your previous comments?

21 DR. BRUCKNER: Just a sort of a comment. This is more

1       general. The impression I'm getting is that the contribution from  
2       playground equipment to background levels, particularly where  
3       you have high water levels, is going to be awfully small. On the  
4       other hand, it is an add-on to what the background is.

5           I'm just curious, I guess, in general, about what we do here  
6       is going to be integrated with EPA's decision on levels in water.  
7       Are those entirely separate things? I'm just wondering about the  
8       impact of what we do here.

9           DR. EDWARDS: I'm Debbie Edwards from the  
10       Antimicrobial Program. We intend to, as I said, or as someone  
11       said earlier, look at areas where it makes sense to aggregate the  
12       exposures. And so we've talked about aggregating maybe  
13       playground and decks and so on and so forth.

14          The issue of the water is interesting in this case because it is  
15       actually part of the background cancer risk in the country. So we  
16       need to take that into account in making decisions about what to  
17       do, just as you said, whether it makes sense to add any additional  
18       risk.

19          But whether we'll actually add them all together, I don't --  
20       we haven't made that determination yet.

21          DR. ROBERTS: Dr. Bates.

1           DR. BATES: I just wanted to extend something that Michael  
2           Kosnett said, and, also, to reiterate the point that I made yesterday  
3           about one of the differences between toxicology and epidemiology  
4           is the uncertainties of the exposure measures. And it's always  
5           important to take those into account.

6           But sometimes you can actually make some predictions about  
7           the bias and the direction of the exposure measure, and that's quite  
8           important because, if you are underestimating the exposure of  
9           concern, that at least errors on the side of public safety.

10          On the other hand, if you're overestimating it, then that's  
11          sort of potentially goes against the public health because you end  
12          up with dividing a too-high factor by an uncertainty factor and  
13          arriving at some ultimate conclusion which is too high.

14          Anyway, it is possible sometimes to make some educated  
15          guesses about the direction of the bias. And to illustrate that by  
16          looking at Masumda study -- which I know something about, I  
17          guess, because it was done by colleges of mine -- the exposure  
18          measure was based on sort of one measure of the water of the wells  
19          which people were using at the time.

20          Now, that will usually tend to lead to an underestimate of  
21          the observed effect level or lowest observed effect level. The

1 reason is that people migrate between the places. And what  
2 happens is that people who were living in perhaps using more  
3 wells with higher arsenic levels will move to places where there  
4 are lower levels and they will turn up in your estimate as showing  
5 effects with lower exposures.

6 And, of course, it will go in the other direction, too. But the  
7 general tendency will be to bias the lowest observed effect levels  
8 and no effect levels down lower. So I guess somebody has  
9 calculated what it is in terms of body weight these from the  
10 Masumda study.

11 So we can feel some confidence that at least for the measures  
12 of effect that were published that we're probably underestimating  
13 the LOAELs and the NOAELs. On the other hand, I know it was a  
14 reasonably rapid examination which was given and there was no  
15 measures of neurological effect for example. There was a  
16 particular emphasis on skin keratoses and pigmentation.

17 So anyway, I would just add that something that needs to be  
18 taken into account, particularly when considering what's the  
19 appropriate uncertainty factor to apply to particular, I find it very  
20 difficult. I'm not sure how to estimate the direction of the bias in  
21 the Mizuta Study. It could have potentially gone either way. It

1 may very much dependent on the opinion of the investigators.

2 So I think that uncertainty is something that needs to be  
3 taken into account particularly if we're considering lowering the  
4 uncertainty factor.

5 DR. ROBERTS: Okay, thank you, Dr. Bates. Let me just  
6 give you my impressions.

7 First of all, I guess I need to say, since in previous Panels  
8 I've been critical of the Agency of not making enough use of  
9 human data. I would have to say in this case that it's certainly fair  
10 to state that you have made very good use of human data and, in  
11 fact, have relied on it, I think, for very good reasons in this  
12 particular case.

13 When you rely on human data, though, I think you're in the  
14 situation where it's very easy -- especially case studies and this  
15 kind of stuff. They're all going to be flawed to one extent or  
16 another. And I think the usual procedure of sort of setting up a  
17 single study is kind of the study with some other supporting  
18 information probably doesn't work very well in this kind of  
19 situation where you really have a lot of studies they all have sort  
20 of one flaw or another.

21 But in this particular case in regard to the LOAEL, they all

1        seem the come up with about the same answer. So even though  
2        each study has a weakness, I think there's some reassurance, I  
3        think, in the fact that all of the studies with their various  
4        weaknesses seem to be telling you the same thing and that is the  
5        LOAEL is right about 05.

6            So I guess my response to the question about using the  
7        LOAEL of .05, I think it's reasonably sound.

8            Again, I'm reluctant -- I'd be reluctant to point to a single  
9        study as the basis of that. I think when you're using this kind of  
10       information, I think that the strength comes from the body of  
11       information, the breadth of information, giving you relatively  
12       consistent results.

13           The other thing that you asked is should the severity of the  
14        effects be taken into consideration. And I think, emphatically,  
15        yes. Because it gets to the uncertainty -- I mean, if we make a  
16        mistake, how serious are the consequences? And I think if we're  
17        talking about effects and effect levels that are associated with  
18        neuropathy, you know, cardiac arrhythmias, potentially life-  
19        threatening events, I think you really need a pretty good buffer.  
20        You need to back off from that.

21           As I looked at the no-effect level, I had sort of less

1 confidence that we had a good handle on a NOAEL. And so I  
2 wasn't real sure about -- and there are impressive numbers with the  
3 Mizuta study. I guess I was a little concerned about whether or not  
4 neuropathy had been adequately addressed as some of the other  
5 commentators had made.

6 I wasn't sure I was ready to hang my hat on that. Plus,  
7 frankly, I suppose it's theoretically possible that you could have  
8 an incredibly steep dose response curve for arsenic where you see  
9 nothing at .015 and then you start seeing serious effects threefold  
10 higher. That made me nervous.

11 I don't have enough confidence. I don't know that the  
12 Agency would have enough confidence to establish the no effect  
13 level with certainty that close to LOAEL with serious effects.

14 So I think we have to back off. And I took the same road that  
15 Harvey Clewell took, and I came up with about the same answer. A  
16 hundred sounded like a lot to me. And the reason is because you  
17 wind up with a reference dose that's really right about where the  
18 chronic reference dose is which is years and years of exposure. I  
19 mean it's 5E to the minus 4, 3E to the minus 4.

20 And for exposures that are six months or less, it just seemed  
21 to be intuitively that there should be more distance there. So I

1 basically tried to see where my comfort level was in terms of  
2 uncertainty factors and I came up with 30 myself again based on an  
3 .05 LOAEL, a factor of 10 for the NOAEL, and perhaps then a  
4 factor of 3 for interspecies.

5 Are there any other comments? Sort of three of us have kind  
6 of weighed in numerically, and I don't know how the rest of the  
7 Panel feels about sort of making comments as well. And I suppose  
8 we ought to decide, I think for the benefit for the people who have  
9 to put together our response to this, it might be useful -- first of  
10 all, I want to see if there are any other questions or any other  
11 comments, and then I'd like to maybe go to a little bit of checking  
12 and make sure we know where we are with this response. Dr. Vu?

13 DR. VU: Thank you, Dr. Roberts. I just wanted to just make  
14 sure that I clearly understand some of the recommendations from  
15 the panel members.

16 The first recommendation I heard is that we ought to use  
17 collectively all the available data to come up with where you think  
18 this effect level would be. And I'm hearing some sense from Dr.  
19 Bruckner's and others have recommended the Mizuta study is a  
20 better study but it only looks at skin lesions and not other endpoint  
21 as well. So, therefore, you need to consider factors that consider

1 gaps of information on different other endpoints.

2 And, also, I understand that you have also considered the  
3 fact that you need to have factors that consider interindividual  
4 variability whether that factor is 3 or whatever that is. So I think  
5 there's a range of different opinions on the size of that margin of  
6 exposure would be, whether it's 10 or 30 or whatever.

7 But that's the sense I got from the Panel. Am I correct?

8 DR. ROBERTS: My notes that everyone who had sort of  
9 weighed in with the margin of exposure coincidently or -- I had 30  
10 for Dr. Clewell, Dr. Ginsberg, and myself. A little bit different  
11 rationale in every case, but we came up with the same margin of  
12 exposure. But those are the only people that I had sort of notes on.

13 DR. BRUCKNER: You missed me.

14 DR. ROBERTS: Were you? Maybe it wasn't clear.

15 DR. BRUCKNER: Dr. Ginsberg more or less seconded what  
16 I had.

17 DR. ROBERTS: Oh, okay.

18 DR. BRUCKNER: I think what we did here was took a little  
19 bit different route, but we arrived at the same answer for the same  
20 reasons which I have down pretty clearly.

21 DR. ROBERTS: And I don't disagree with anything you've

1       said. I don't know if there is any disagreement between Dr.  
2       Clewell's rationale and yours. I think it winds up with the same  
3       margin of exposure. We just had a little bit different comfort  
4       levels in terms of how to get there. Dr. Kosnett.

5             DR. KOSNETT: You mentioned the Masumder Study. But if  
6       we're talking only up to six months, than that study is not  
7       germane. Right?

8             DR. BATES: That's probably true.

9             DR. VU: As Dr. Benson had described that the superfund's  
10      chronic exposure scenario is a little bit different from the Office  
11      of Pesticide definition of duration of exposure. And that's why the  
12      OPP was proposed to use the Mizuta study instead of the Masumda  
13      study.

14            But there are some limitations, you know, for the duration  
15      exposure are different. But as I think collectively you all said  
16      they all pretty much in the similar ballpark regardless of how you  
17      look into the endpoint you picked. So I think there's a difference  
18      in opinions in which study you select as opposed to look at  
19      collectively.

20            So there are different approaches. And I'm not sure I'm  
21      hearing the Panel have the same, you know, opinions on which one

1 to pick. But I've heard clearly from Dr. Roberts and Dr. Ginsberg,  
2 Dr. Bruckner, is to use a more aggregate kind of -- you know, all  
3 the information together as opposed to select one single study with  
4 supporting study as Office of Pesticide Program has proposed.

5 DR. ROBERTS: Dr. Bruckner.

6 DR. BRUCKNER: Do you feel compelled to use or rely on  
7 just one study? Or would you feel comfortable relying on one  
8 study but then saying that -- Bob Benson has come up with a lot of  
9 studies which support that study. I guess I'm wondering if at EPA  
10 you really have to point to a single study. That's my question.

11 VOICE: I agree with that. I think overall the analysis has  
12 been pretty consistent. And I'd feel very comfortable using the  
13 data base as a whole as you have seen from Dr. Benson which add  
14 support to that. And from what Dr. Roberts has mentioned as well.

15 DR. ROBERTS: I think Dr. Chin wanted to make a comment.

16 DR. CHIN: Yeah. And I agree with what Dr. Benson  
17 mentioned. There are so much studies and since like come out  
18 with similar kind of numbers. But the reason that we pick out the  
19 Mizuta Study is part of the reasoning is that this study it  
20 describes, let's say, for all different kind of symptoms very  
21 clearly.

1           And if you notice that in this study it's clearly stated that  
2           that the neurotoxic fact and the skin lesions are things that more  
3           come up in the later stage of the exposure.

4           And the reasons aren't OPP proposed to use this study as a  
5           primary study is because it's on the beginning. There is so many  
6           other symptoms stated in these studies, in this case report. And  
7           part of the reason that OPP used this study is that if we can catch  
8           the first phase, put all the reported symptoms into consideration,  
9           if we can kind of protect in the first stage of the exposure, more  
10          like to prevent the first stage of the symptoms come out then later,  
11          if you notice some of the neurotoxic effect would come out even  
12          after the cessation of the exposure.

13          So if we can protect the first stage, the first phase of the  
14          symptoms, then we can prevent the neurotoxic effect or skin lesion  
15          and make sure that that is really protective. This is the reason that  
16          when we put in the report we also put edema and other symptoms  
17          into consideration. I just wanted to make it clear.

18          DR. ROBERTS: Are there any other comments or has anyone  
19          that hasn't spoken that would like to add to the discussion? Dr.  
20          Ginsberg.

21          DR. GINSBERG: Real briefly. I think that the way to

1 describe the levels that are derived rather than saying that we have  
2 a separate acute number and a separate subchronic number based  
3 upon Mizuta on the one hand and based upon some longer term  
4 studies on the other, it may be good to just start the whole  
5 discussion by talking about the data base as a whole and the  
6 similarity in the LOAELs, and if there are NOAELs, between very  
7 short term and longer term and use that as a justification to  
8 simplify the whole process and develop one number that cuts  
9 across the two time frames and therefore you'd get out of the box  
10 of people having a problem with this study or this exposure  
11 estimation in this case.

12 And so I think you can start with an aggregate data set and  
13 develop an aggregate number that is protective of the kinds of  
14 concerns that we just heard.

15 DR. ROBERTS: Dr. Kosnett rebuts.

16 DR. KOSNETT: I just have to -- and I don't know if we're  
17 talking apples and oranges. But if we're talking up to six months,  
18 then, you know, if you want to talk about a LOAEL of .05 and then  
19 apply a safety factor, I follow the discussion.

20 But if we're talking about a chronic exposure or years of  
21 exposure, then the whole issue -- and maybe I've rambled on and

1 wasn't clear. But the whole issue of the .015 milligrams per  
2 kilogram per day, which is in this document that was sent to us and  
3 is basically cited as a reference dose. A reference dose --

4 DR. ROBERTS: Right. I'm sorry.

5 DR. KOSNETT: I'm talking about the February 2001. If  
6 that's a reference dose, I think there's some concern about that as a  
7 reference dose for up to seven years of exposure. And I think  
8 there's a lot...

9 DR. ROBERTS: And I think we seem to be coming up with a  
10 lower number than that in our discussion.

11 DR. GINSBERG: We're not saying that that's the reference  
12 dose.

13 DR. ROBERTS: Yeah, Dr. McDonald.

14 DR. MCDONALD: Not really working in risk analysis, I  
15 find some discomfort that we're sitting around essentially  
16 guessing at a number. But it is impressive how many sources of  
17 information are being used, especially the many references that  
18 Dr. Kosnett has produced.

19 But it strikes me that it's not so important what number we  
20 come up with today. Because really we're seeing more and more  
21 that the risk from playgrounds is going to be relatively small

1 compared to the background so it's the number that's going to be  
2 used when we put the aggregate together of all sources of arsenic  
3 that's going the matter.

4 DR. ROBERTS: Any other comments that anyone wants to  
5 add. Before we wrap this up or as a way of wrapping this up, I hate  
6 to put you on the spot, Dr. Bruckner

7 DR. BRUCKNER: Don't do that then.

8 DR. ROBERTS: But I think it will be useful if you could try  
9 and summarize as the lead discussant on this question the Panel's  
10 response. And then we can all sit back and listen and say, yeah, I  
11 think that's right except for. Or I think that will help if we all sort  
12 of at one place at one time have a feeling for what the Panel's  
13 recommendation and input would be.

14 DR. BRUCKNER: I'm wondering if I can synthesize all of  
15 that. I have it all down on paper.

16 DR. ROBERTS: Give it your best shot.

17 DR. BRUCKNER: That's not going to be -- I wonder how  
18 useful that is really, though. I really believe I've captured most  
19 everything. I'd really prefer to do that, perhaps, on Friday or after  
20 I've had a chance to synthesize all this.

21 DR. ROBERTS: Well, yeah, but sometimes it helps, I think,

1 to hear what -- different people hear different things in a  
2 discussion. And I think it would be -- and if you're reluctant to do  
3 it, maybe I can see if I can twist someone else's arm.

4 DR. BRUCKNER: Why don't you. I do better sitting and  
5 thinking and writing.

6 DR. ROBERTS: Is there someone else who would like to  
7 volunteer to capture what they feel they've heard in this discussion  
8 in 35 words or less?

9 DR. CLEWELL: Sure.

10 DR. ROBERTS: Dr. Clewell, thank you.

11 DR. CLEWELL: In brief, I think we agreed that the body of  
12 literature on short-term exposure supports a LOAEL of .05, but  
13 that we have significant concerns about the potential effects at  
14 that LOAEL and feel that, therefore, at least a factor 30 below  
15 there is required as a margin of exposure rather than the 10 that  
16 may have been considered.

17 DR. ROBERTS: I think that would I also add that some  
18 panel members felt that a LOAEL or -- I'm sorry -- a NOAEL could  
19 be used of .015 with an uncertainty factor of 10.

20 DR. CLEWELL: No.

21 DR. ROBERTS: That would result -- no?

1 DR. CLEWELL: That's not what he meant.

2 DR. ROBERTS: No, I know that wasn't Dr. Kosnett. I'm  
3 trying to capture Dr. Ginsberg and Dr. Bruckner's road to the same  
4 answer. And I think it would be important to capture that as well.

5 DR. BRUCKNER: But Gary came back with the  
6 recommendation that we talk about the consistency and how large  
7 the data base is and how we arrived at the same numbers. I think  
8 maybe your idea of actually going with that composite number of  
9 .05 and then going to the factor of 3 and 10 would be fine. There  
10 were other things. I guess I can chip in.

11 DR. ROBERTS: We're all traveling the same road.

12 DR. BRUCKNER: We're all traveling somewhere. I think  
13 our other concerns were, like you said, the steepness of the dose  
14 response curve or lack, we don't have information on that, the  
15 severity of the effects, the lack of looking at neurological  
16 endpoints and concern about lead and other metals --

17 DR. ROBERTS: Yeah, I think there was --

18 DR. BRUCKNER: -- and data points.

19 DR. ROBERTS: I think there were several concerns that  
20 were raised and we need to be sure that we probably get all of  
21 those captured in our report. And they included interactions

1 among the metals, and they included -- well, uncertainty about the  
2 data sets, those kinds of things.

3 So I think with input from panel members who have made  
4 those comments, I think we can be sure that those get captured in  
5 the record.

6 DR. GINSBERG: Will we have a chance to review each one  
7 of these question's write-ups at some point as a Panel?

8 DR. ROBERTS: Absolutely, oh, yes.

9 DR. GINSBERG: So that's if Jim blows it.

10 DR. ROBERTS: Yeah, that's right.

11 DR. BRUCKNER: What I'm proposing to do is to perhaps  
12 write this up sometime late tomorrow and have it typed up and  
13 everyone can have a look at it. Tomorrow morning, you know --

14 DR. ROBERTS: It's still early. What else are we going to  
15 do.

16 DR. BRUCKNER: Maybe I can have something to you  
17 Friday morning.

18 DR. ROBERTS: Dr. Wargo.

19 DR. WARGO: I have a source of confusion maybe people  
20 can help me out with. When you talk about the uncertainty factor,  
21 I'm assuming that you're talking about uncertainty in deriving a

1 NOAEL; that you're not talk about uncertainty that's associated  
2 with exposure. And those inside EPA know this distinction very  
3 well because it is at the core of what the Food Quality Protection  
4 Act demands.

5 It demands the Agency look at the reliability of the toxicity  
6 data and demands that they look at the reliability of the exposure  
7 data. And uncertainty from either of those two sources can be the  
8 justification for applying an additional tenfold safety factor  
9 beyond the intraspecies and interspecies safety factors that Dr. Vu  
10 distinguished for us earlier.

11 So my impression about this discussion is that we've  
12 basically pushed the exposure issue aside and we'll deal with that  
13 tomorrow. I'm hoping that's the case.

14 DR. ROBERTS: Yeah. Well, I mean basically I think we set  
15 it aside from the context of developing a short- and  
16 immediate-term reference dose.

17 DR. WARGO: Well, my assumption is that you're not  
18 developing a reference dose through this discussion. Because if  
19 you are suggesting what an acceptable level of exposure is, I'm  
20 very interested in knowing the Agency's position about how  
21 uncertainty in the exposure data set should be applied and whether

1 or not they're going to use a consistent approach as is demand  
2 under the Food Quality Protection Act for in this case.

3 And if you read very carefully the language that is in the  
4 document that they prepared, there is a statement for both  
5 chromium and for arsenic that the Food Quality Protection Act  
6 does not apply to their deliberations in this case.

7 Now does that mean -- is that statement in there to relieve  
8 you from the need to consider the uncertainty in the exposure  
9 assessment as a basis of a choice to apply an additional tenfold  
10 safety factor when setting an RFD? Or are you going to apply the  
11 same policies that you would apply to all the other food-use  
12 pesticides to this situation as well?

13 DR. ROBERTS: Well, I think we're going to need some  
14 clarification from the Agency on that.

15 DR. EDWARDS: Okay. I'm Debbie Edwards. And I'll do  
16 the best I can.

17 The Food Quality Protection Act actually amended, as you  
18 know, FIFRA and the FFDCA. And the 408 Safety Standard is in  
19 the FFDCA. And this use does not fall under that law. None of the  
20 CCA uses do.

21 So, therefore, we wouldn't actually add what you call an

1 FQPA safety factor as written up in that law. We want to take into  
2 account uncertainties, however, for children. And so what we're  
3 doing, what we're trying to do here, is get appropriate uncertainty  
4 factors, yes, for a reference dose or for --

5 DR. WARGO: Okay.

6 DR. EDWARDS: But for the uncertainties for the exposure,  
7 we can talk about those in terms of values that are appropriate to  
8 select, to take into account the uncertainty when we talk about that  
9 tomorrow.

10 DR. WARGO: So what I'm hearing from that response is that  
11 uncertainty in the exposure data sets should be used as a basis for  
12 the decision that you're about to make. And if that is the case --

13 DR. EDWARDS: No, that's not correct.

14 DR. WARGO: That's not correct.

15 DR. EDWARDS: That's not correct. What I'm saying in the  
16 uncertainties for the exposure should be built into the residue  
17 values and the assumptions that you choose for your exposure  
18 assessment but not added into the uncertainty factor for setting  
19 dose response, you know, hazard endpoints because it doesn't fall  
20 under --

21 DR. WARGO: I guess what I'm trying to do is I'm trying to

- 1      reserve the right to explore the uncertainty in the exposure side of